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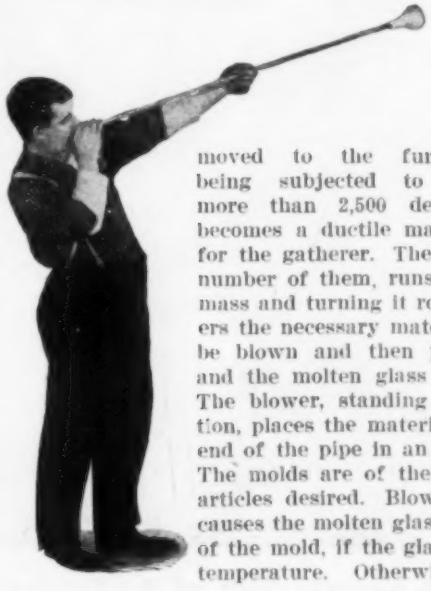
How Cut Glass is Made

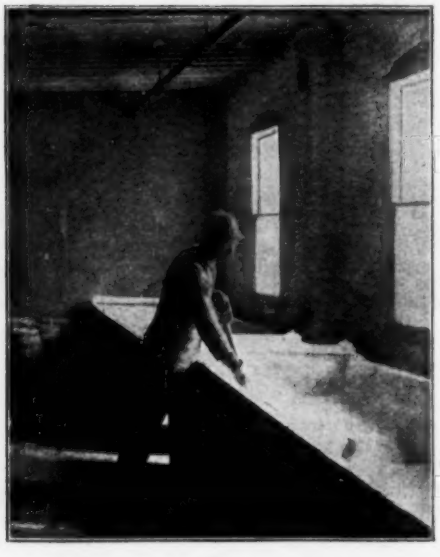
American Product Rivals That of Europe--Its Perfection Depends Upon the Skill of the Workman and Secrets Which are Carefully Guarded

In Russia and in the Berkshire Hills of the United States there is found a sand peculiarly adapted to the making of the most beautiful of all glass products—cut glass. White as flour and almost as fine it is shipped from Massachusetts in car loads. The industry to which this silica sand contributes is among the most interesting in the United States, and the workers who engage in it hold an unique place among American craftsmen. A day at a cut glass-making center, witnessing the marvelous skill of the workmen and the various processes from the molten mass to the finished product, is a day of education and profit, well worth while.

The sand from the Berkshire Hills having reached its destination, it is mixed in large vats or bins with such other minerals as potash, red lead and saltpeter. In the mixing of the sand and the other necessary minerals there is a secret which is carefully guarded, for it is in this initial operation that the real quality of the glass is determined and on this that its ultimate beauty depends.

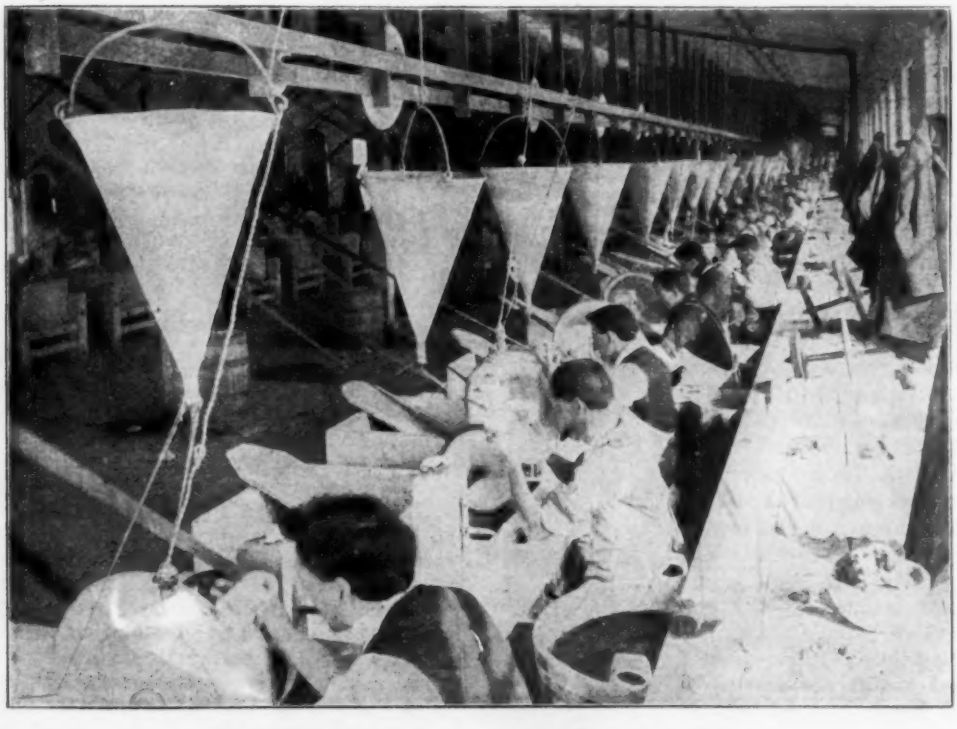


When mixed properly the "batch," as it is called, is removed to the furnaces where, upon being subjected to a temperature of more than 2,500 degrees Fahrenheit, it becomes a ductile mass and is soon ready for the gatherer. The gatherer, there are a number of them, runs a long pipe into the mass and turning it round and round, gathers the necessary material for the article to be blown and then passes both the pipe and the molten glass upon it to a blower. The blower, standing upon a slight elevation, places the material gathered about the end of the pipe in an iron mold at his feet. The molds are of the shape of the various articles desired. Blowing through the pipe causes the molten glass to assume the shape of the mold, if the glass is at just the right temperature. Otherwise, it is placed in



The Sand from the Berkshire Hills is Mixed in Large Vats or Bins with Such Other Minerals as Potash, Red Lead and Saltpeter.

A Workman Outlining Designs on Wine Glasses. Some of the Prettiest Designs in Cut Glass Have Come from the Workmen.



A General View of the Cutting Room

what is known as a "glory hole" by a helper for reheating. The molds referred to are only used in blowing certain kinds of articles. Other shapes are obtained by skilful rolling of the molten glass gathered about the pipe upon a smooth surface, the workman also having in hand a pair of compasses which assist him in attaining accuracy of shape and size. All these processes produce the blank. When this blank is properly cooled it is ready for the designers and the cutters. The cooling process consists in slowly moving the blanks from the front of an oven to the rear, the cooling

Ready to Place the Blanks in the Ovens

very often requiring a day or two. The front portion of the oven is, of course, kept very hot while the rear is comparatively cold. Many of the great factories which perform the cutting and finishing operations do not make these blanks, but buy them from factories which do make them.

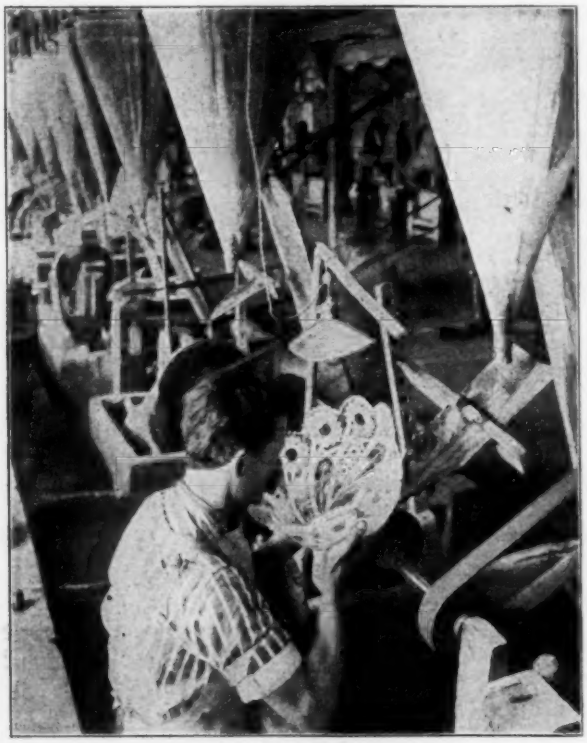
The skilled workmen in the blank-making departments receive the highest wages, higher in most instances than those known as strictly cut-glass workmen. Two men, whom we witnessed at work among the blowers, make $7 and $7.50 per day, respectively. One of them had been thus employed

A Smoother at Work

for 35 years and his son was working at the same trade. It is in this department of glass manufacture, however, that the latest machinery will make noticeable

Accurately Shaping the Article by Means of Compasses

inroads. These men who make big wages in producing glass are usually a very desirable class of citizens. The standard of intelligence in all lines of the glass industry, we are told, has been raised immeasurably during the past 10 years. While these men spend money freely, still they are becoming home builders. In Toledo, O., where the glass interests have long been among the largest industries of the city, it is said that more people own their own homes than in any other city in the United States. At Alexandria, Ind., which has for years been the center of large glass-working interests, it is said that the average glass worker gives his wife $20 a week for the expenses of the house. Alexandria is one of the places where machines have been introduced to take the place of many skilled workmen.



A Skilled Glass Cutter at Work on a $300 Punch Bowl

But to return to the making of a cut-glass article, when the blanks are ready for the subsequent operations the various designs for the cutters are marked upon them with red lead. Prizes are sometimes offered workmen for new designs and some of the prettiest designs in cut glass have come from the workmen themselves.

As heretofore stated, the cut-glass worker holds an interesting place among American craftsmen. He is one of less than 2,500 engaged in his occupation, there being 1,200 to 1,400 organized cut glass workers in the United States, while those not organized are roughly estimated at from 800 to 1,000. These figures do not include the blowers and helpers who make the blanks. It has been estimated by one prominent manufacturer that the cost of a complete cut glass article, blank and all, in wages is nearly 60 per cent of its value.

The glass cutters sit side by side at wheels. In funnel-like arrangements overhead there is a mixture of sand and water which is fed to the wheels as the cutting progresses. The first operation in cutting the designs is called "roughing," and this is done upon a steel wheel. The article to be cut is held against this wheel which wears its way to the desired depth. To know just how deep to cut is one of the chief tests of the cutter's skill. At almost any stage of the cutting operations a very expensive piece of glass may be ruined by an inexperienced hand. It is no wonder, then, that five years' experience as an apprentice are required. One of the photographs shows a skilled workman roughing a punch bowl, which, when completed, will sell for a sum in the neighborhood of $300.

From the "rougher" the piece of cut glass passes to the "smoother," who also works at a wheel. In this instance it is a stone wheel, the stone being imported from Europe. This wheel and its operator add a certain smoothness to the work that is essential before it goes to the polisher. The polisher with pumice stone and wheel of wood gives the finishing touches. After the articles have been finished and washed they go to the packing and shipping departments, and from there are sent out to all parts of the world.

Another of the photographs pictures the punch bowl which was presented to the late President McKinley and which is said to have been the largest cut glass punch bowl ever made. It required two expert glass cutters nearly four weeks to make this bowl. It is in two pieces and weighs 75 pounds. The color is perfect. America to-day excels in the production of cut glass. In fact, it was a Toledo company that brought the art to its present high standard of beauty. Other American factories now produce beautiful cut glass articles, however, and wherever these have been exhibited in competition with the product of foreign countries, they have excelled in scintillating radiance, in crystalline clearness and in richness of design.

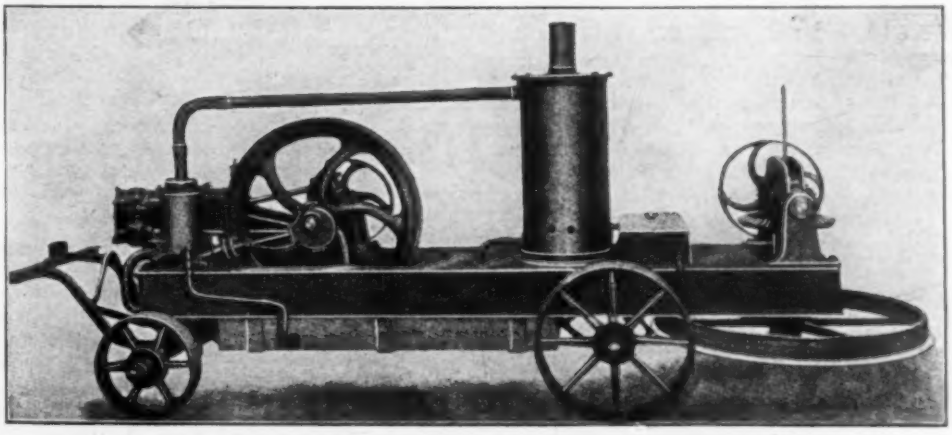
The Cut Glass Punch Bowl Presented to President McKinley

Portable Stone-Cutting Machine

A portable stone-cutting machine, deriving its power from a gasoline engine, is in successful operation in a large quarry in England, and is proving a great labor saver, thus saving money, too.

This apparatus is designed to cut rocks or boulders in their natural position by means of an endless steel wire cutting in both inward and outward directions. The cutting medium used is water and finely-ground quartz contained in separate vessels, but fed together in a trough, with a spout terminating directly over the cutting wire where it enters the rock.

To obtain a vertical cut in the rock where the cutting wire is running at an angle, it is necessary to employ what are termed rock guides, the function of which is to guide the wire round the corners of the block to be cut out. The guides consist of center spindles, 2 inches in diameter, which revolve on centers, over which weighted sleeves slide. A 3-inch hole is first cut down with a jumper drill, the rock guide being inserted in this hole and stayed in position at its outer end by wire ropes securely fastened by pegs into the rock. The cutting wire is then led round the spindles, one at each corner, and is fed down into the rock by means of the weighted sleeves.



An English Portable Stone-Cutting Machine

France Wins in the Automobile Cup Race

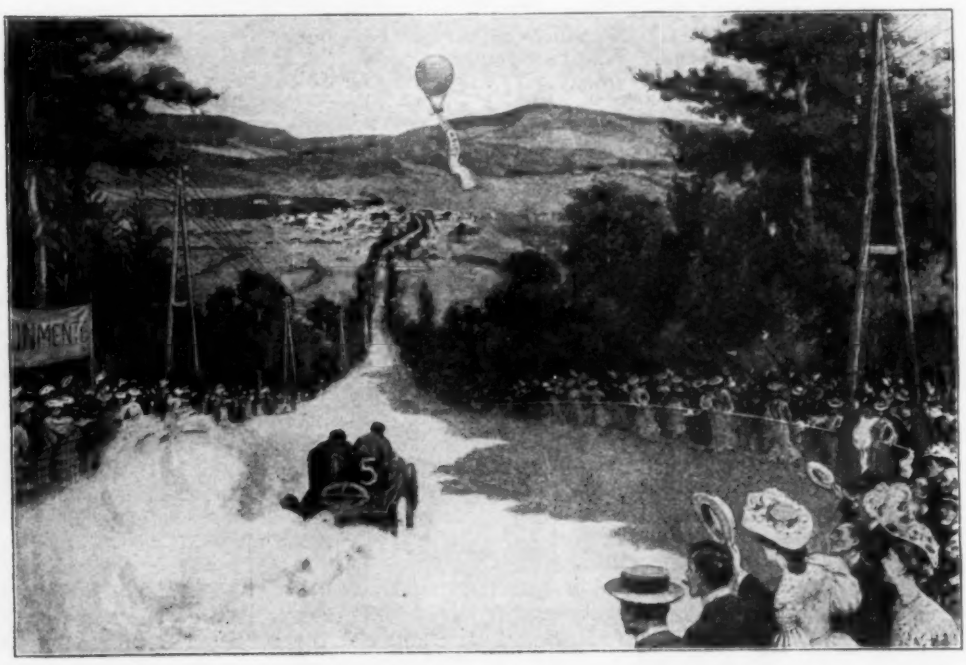
France now holds the international trophy which gives her automobile industry foremost rank in the world. This is the third time France has held the trophy since the international contest was first instituted in 1899 by James Gordon Bennett of New York. England held it once and last year it was won by Germany.

As the prize is always defended in the land where it is held the race course was laid in Germany in the neighborhood of Saalburg, where the start and finish took place between two huge grandstands on either side of the road. Each of these grandstands accommodated 2,500 people and were connected by a tunnel under the roadway. Seats were sold at $12.50 each. Ten telegraph and three wireless telegraph stations were installed to dispense news of the progress of the race.

Two other official stands were erected at other points on the course, while different parties erected stands at various other points along the course, though these had no telephone connection. Near the grandstands the roads were sprinkled with Westrumite to lay the dust. Cross roads along the course were closed at an early hour and along the entire distance of about 85½ miles men were stationed about 20 rods apart. To make the race the required length the course must be covered four times, about 342 miles in all.

The contestants represented seven nations, Austria, Belgium, France, England, Germany, Switzerland and Italy, each entering three cars. At an early hour the crowds began to gather, coming by every means available, by carriages, automobiles, motorcycles, on foot, by trolley cars or steam. At 6:20 the Emperor and Empress and many other members of German nobility arrived and German patriotism ran high.

The race began promptly at 7 o'clock, the cars starting at intervals of seven minutes, each start signaled by a bugler, who stood with a trumpet at his lips, his cheeks puffed out and his eyes watching the wheels for their first revolution. The cars of each nation were painted in a color by which they might be distinguished from the others as they careened past the grandstand. After



View of the Course from the Saalburg--Captive Balloon Hanging Over It.

can be made that would not work too great a hardship on owners having boats in the business. For instance, there could be asbestos curtains fitted in two cross sections at least on each deck, which would confine the fire to the part of the boat where it might originate. Instead of hose being reeled up it could be stretched and held in brackets or beckets ready for immediate use. Added to this, the use of fire-proof paint and two reliable men at least on each deck to patrol it, watch out for fire and do nothing else, would reduce the danger on boats now in commission. While in wooden boats to be built steel bulkheads should incase the machinery to the upper deck, iron deck frames and carlins and steel tube stanchions should be fitted throughout. In fact, wherever metal could be used to advantage and not make the boat cost a prohibitive price for the business it is built for, it should be employed. Add to these precautions, eternal vigilance, and every excursion boat will be as safe as one's home."

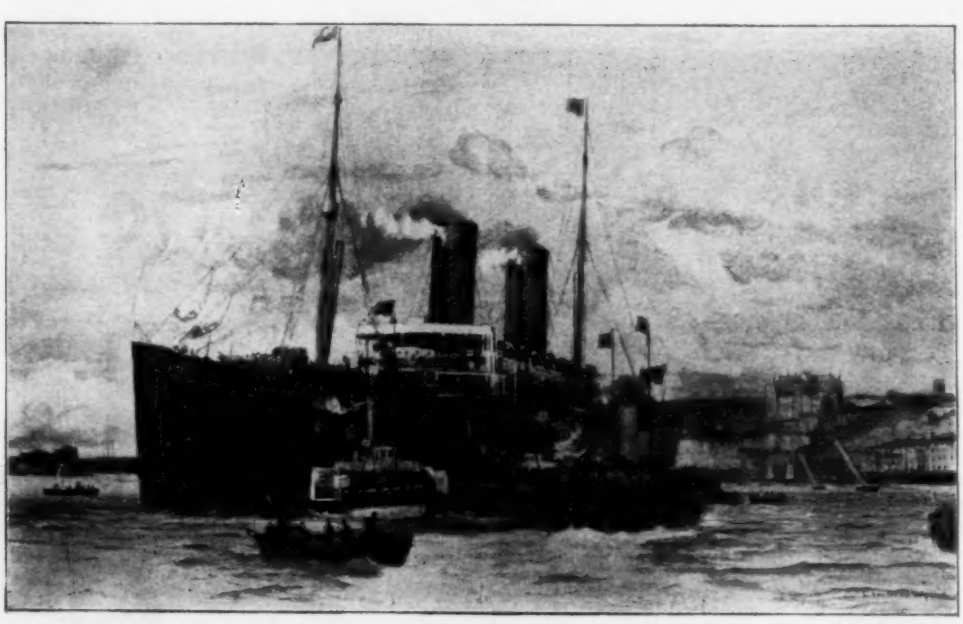
THE RATE WAR BETWEEN ATLANTIC STEAMSHIP LINES.

In the great rate war which has been raging between German steamship lines and the Cunard line, while the evil influence extended wide on every hand, the United States was the chief victim.

So frantic were the opposing factions in the endeavor to outdo each other in the cutting of steerage fares that the rate was reduced from $20 and $30 to $8.75 per head.

While the laws of the United States regarding emigrants, their physical, mental, moral and financial condition and abilities are, if possible, more rigidly enforced than ever before, the low rate removed the chief protection of a country which, while she has ever befriended the emigrant, still excludes those who would sap her vitality. The higher rate brought in the main those who had the energy and purpose to persist until the sum required was saved, thus proving themselves in the mere endeavor. With the rates less than $10 from London to New York the off-scourings of the earth might take advantage of them and such emigrants are not wanted here.

England became anxious as to the effect on Canadian emigration as many points in Canada could be reached more cheaply by way of New York than by Quebec. The losses, it seems, will fall more heavily on the German lines as they depend more on their passenger traffic than does Great Britain.



Emigrants Boarding an Ocean Greyhound at Queenstown

all the contestants had made their start, which took some time, there were long intervals between the flashes of color as they whirled past. These intervals were relieved by music and refreshments for which ample provision had been made for the great crowd. From the first the interest centered in Thery of France, Jenatzy and De Caters of Germany. The other cars were all hindered more or less by defects which developed at the last moment. Thery, driving a Georges Richard-Brazier car, finished the four rounds in 5 hours, 50 minutes and 3 seconds, just 11¼ minutes less time than Jenatzy who drove a Mercedes car and whose time was 6 hours, 1 minute and 28 seconds. Baron de Caters came out third, 45 minutes and 10 seconds behind Jenatzy.

France had won the trophy, but the event was marked by the heartiest good will on the part of Jenatzy, the German, who won last year.

The "General Slocum" Disaster

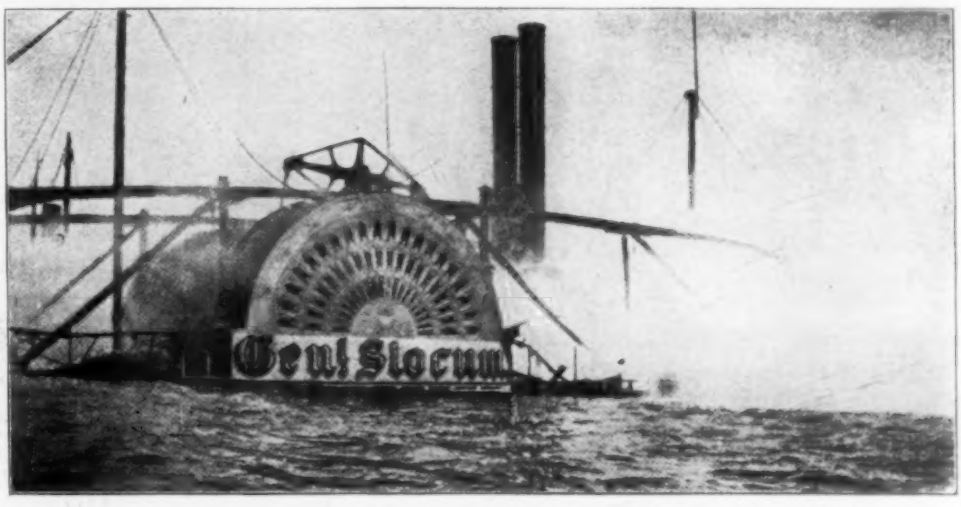
In the wake of the "General Slocum" disaster of June 15, in which over 900 persons, mostly women and children, lost their lives, comes a discussion by the press of the country as to the best means of avoiding such horrors in the future. That criminal carelessness existed somewhere was evident on examination of the rotten life-preservers to which many of the ill-fated passengers trusted themselves. These were shown to be filled with crumbling cork and glue and they sank with their precious burdens when they reached the water. Hose which burst at the first attempts to use it; lifeboats securely wired so that they could not be lowered; confusion among the crew who were untrained for such an emergency, having had no fire drill whatever, and a long run upon the waters with the flames raging every moment more fiercely and shrieking women and children falling into the hold which had become a fiery furnace, or else leaping into the water to meet a slightly less horrible death; these are some of the stories told by the few hapless survivors.

Marine papers agree that excursion boats can be made safe from fire and some of them forecast what the future construction will be. The American Siren and Shipping says:

"There is no reason why the superstructure of one of these craft should not be almost wholly fireproof. Light steel could take the place of wood in nearly every particular, and the asbestos coverings now available are a protection which it is almost criminal not to use. There is no reason, either, why every deck of such craft should not be divisible by fireproof sliding doors or asbestos curtains to prevent or at least retard the sweeping of flames from one end of the vessel to the other. These are things which must come in time, just as certainly as the theaters have been safeguarded."

The Marine Journal coincides with this view in several particulars. It says:

"As a safeguard against fire on steamboats there are many improvements that



The Excursion Boat which Carried Almost a Thousand to Doom

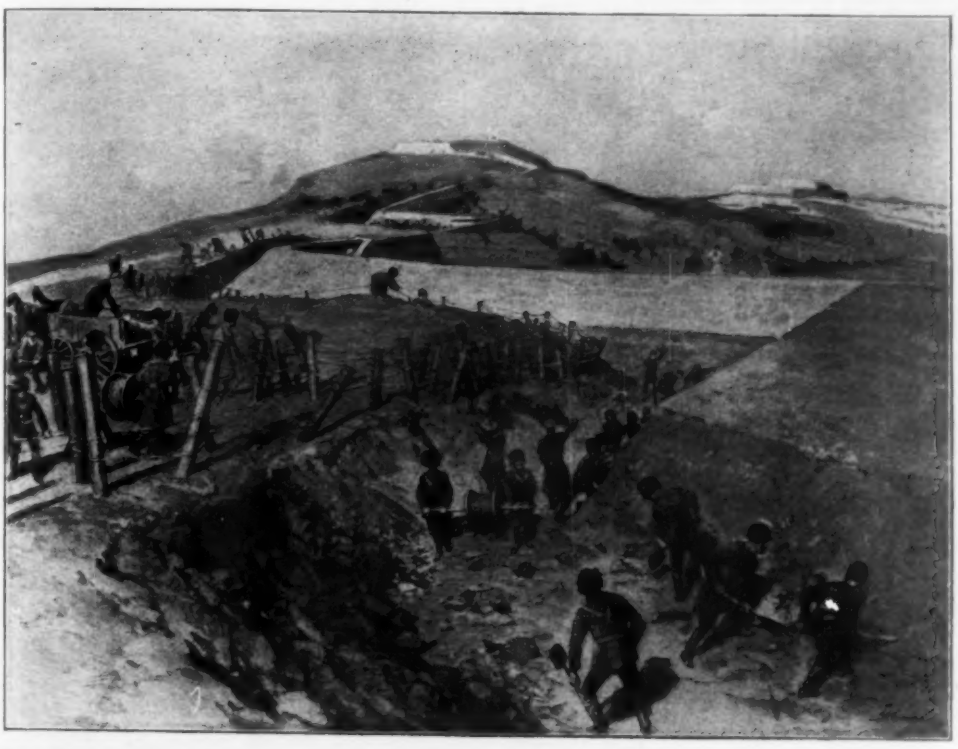
Mechanical Features of the War

The gaping astonishment with which the world has followed the movements of the Japanese forces in the Far East has now settled into the hush of expectancy while it awaits the outcome of the approaching crisis. Within the last month the wonderfully planned and admirably executed Japanese campaign has been completely carried out, and now there remains to be seen what the congested forces in the vicinity of Port Arthur and Mukden will do.

For years to come the world that has watched the daring advance of the little oriental fellows they believed to be so far behind the times will tell how its eyes were opened.

Brief sentences occurring now and then in all the press reports reveal one of the secrets of the Japanese's remarkable success. At the Yalu it was a finely planned system of pontoon bridges; at Telissu it was batteries connected by telephone; in a naval engagement it was wireless telegraphy communication with a scout ship; and recently a war balloon was successfully used. These things show how adaptable the Japanese is to modern conditions.

The Russians are strengthening Port Arthur by every means possible. Around the Russian stronghold they have erected miles of barbed wire entanglements and within these are the fortifications. The struggle will be Titanic.



Russians Constructing Barbed Wire Entanglements Around Port Arthur

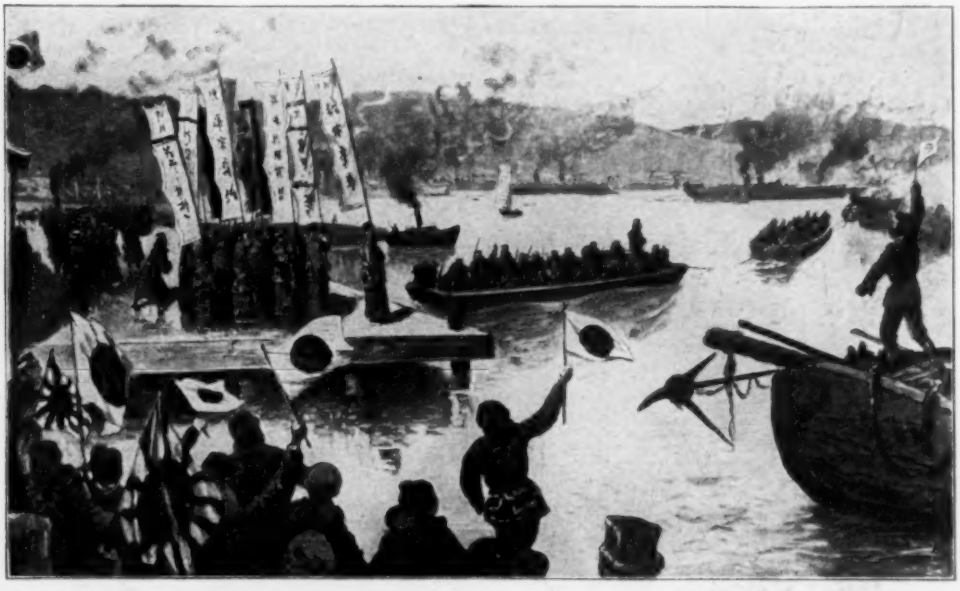
At this time no Jap remembers his individuality; with brave hearts, mothers and wives and daughters take leave of their dear ones, praying, not so much for their safe return, as for the success of their

cause. We are told that the men of Osaka, Japan's great commercial city, for a quarter of a century have borne the brand of cowards, so that no Osaka man was deemed worthy of even the least of service medals, and yet at the battle of Nanshan which ranks the Japanese with the foremost military powers, it was the Osaka division that, when the day seemed lost, charged up the heights and, planting the flag on the hilltop, inspired the fagged-out forces on to victory.

When, from the home port the Japanese troops embark for the scene of the war, from every hand the people lift up their resounding cheers. Flags are unfurled and

But once have the heavy clouds which overhang Russia lifted, and even then though she succeeded in sinking one Japanese vessel and disabling two others, with a loss to Japan of about 1,000 men, the move is generally considered to have been of no strategical importance. Admiral Skrydloff, the commander of the Vladivostok squadron which made the successful raid in the Korean straits, is a man of imposing personality, and to him the Russians look with admiration and renewed hope. The illustration shows him standing on the bridge of his flagship.

The only great disaster that has overtaken Japan during the entire course of the



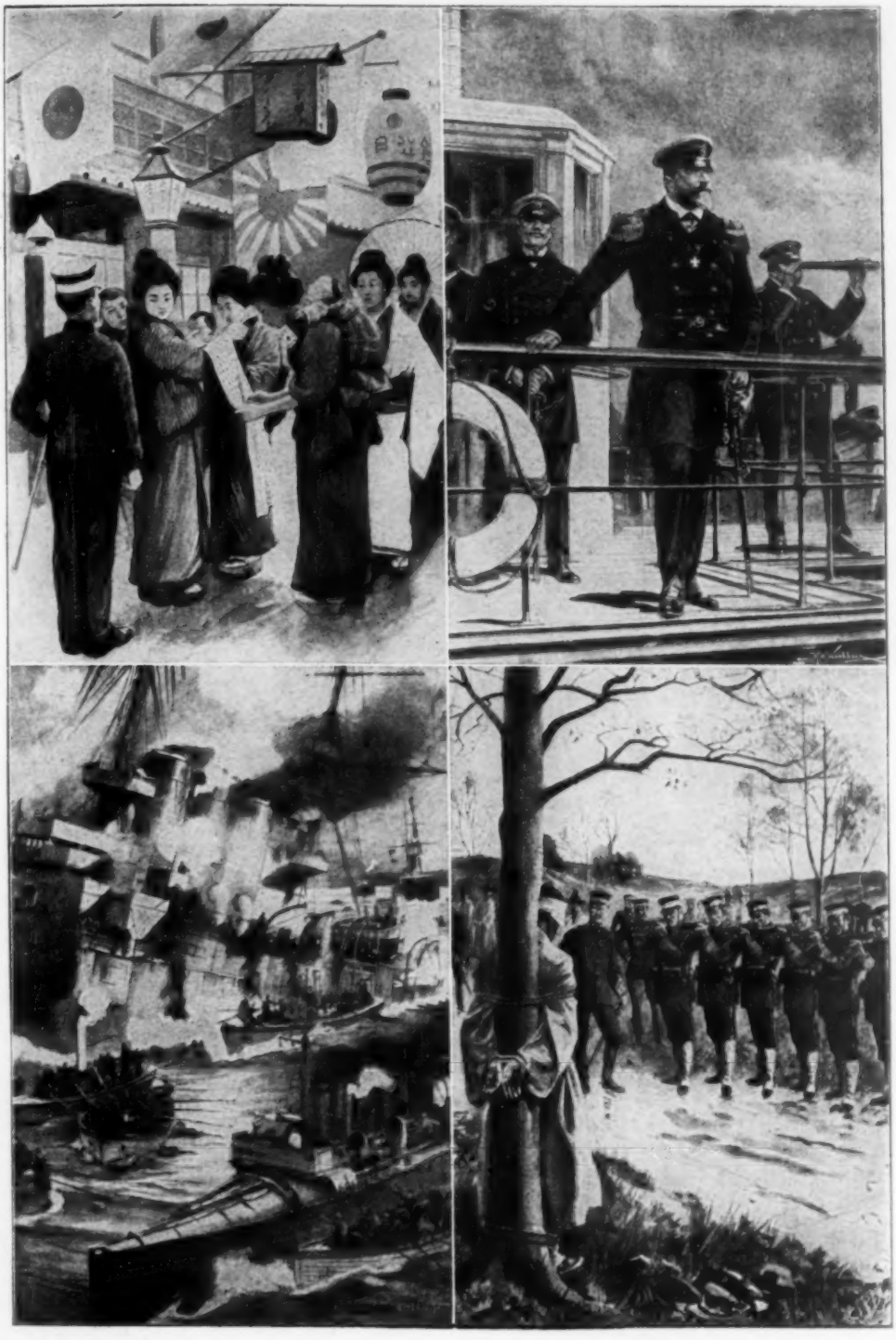
Japanese Embarking at Nagasaki for the Scene of the War

the scene with all its oriental trappings is most picturesque.

One of the strangest of Japanese customs is the stitching of a safety girdle which is supposed to charm the life of the soldier who is so fortunate as to possess one. A woman who has someone in the war passes along the street carrying a long narrow piece of cotton stuff on which there are a thousand black dots. As she goes she requests different women to put a few stitches in the girdle, until at last a thousand women have each passed a thread through one of the thousand dots. Sometimes a number of women will gather around one who has a dotted cloth.

war, was the destruction of the battleship "Hatsuse" by a mine nine miles off Port Arthur. All the nations have condemned Russia's action in strewing the high seas with floating mines. The "Hatsuse" was of 15,000 tons displacement and cost over a million dollars. With her were lost 431 men, while 82 were injured, among them being a number of officers.

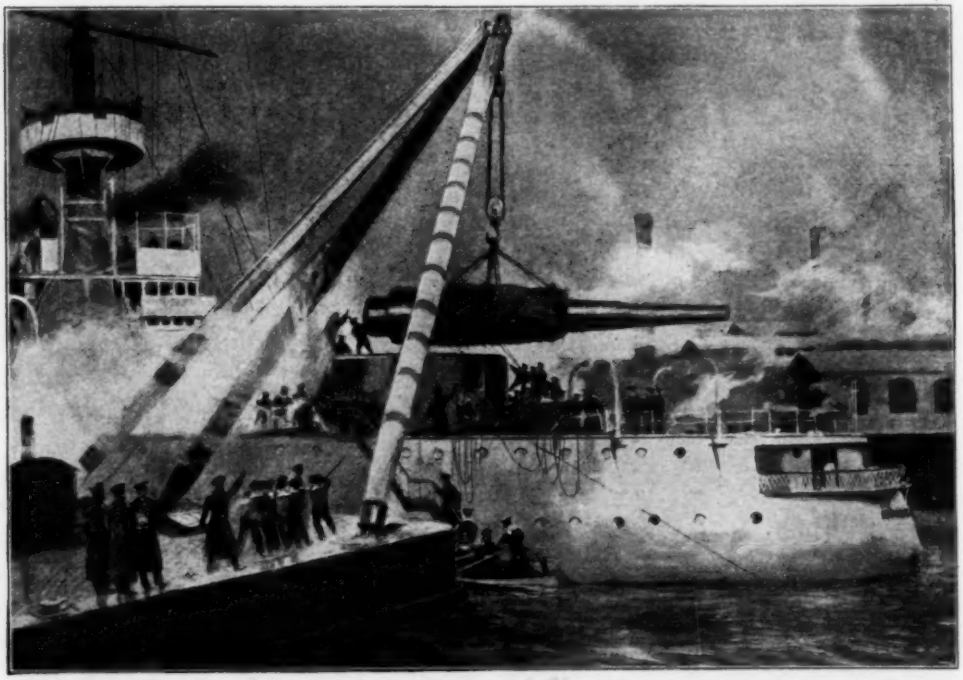
Summary punishment is meted out by the Japanese troops to Russian spies. Martial law governs the case and the decision and punishment are speedy. The illustration shows a Japanese soldier shooting a Korean spy who had given information to the Russians.



The Safety Girdle
Destruction of the "Hatsuse"

General Skrydloff
"Death to the Spy"

Russia's fleets, although they have made a far better showing than her land forces, have been singularly unfortunate. They have barely been able to withstand the repeated attacks on Port Arthur by the Japanese vessels and have met heavy reverses at all times. One of the singular facts has been that her greatest losses have come from disheartening accidents resulting from causes in her own control. Whether this signifies that she is careless or ignorant the watching nations are puzzled to decide.



Mounting the Guns of the New Baltic Squadron

Now she is rushing the new Baltic squadron to completion and the scenes at the Nevsky, the Baltic and the new Admiralty shipbuilding yards, where the work is being carried on day and night, are scenes of great activity. Mighty cranes are used to lift the heavy 12-inch guns into place, while smaller guns are mounted by means of temporary derricks. The yards are located in the Neva river near St. Petersburg.

One of the most daring and terrible charges was made with lances during the fight at Wafangtien by the Fourth and Sixth Companies of the Eighth Siberian Cossacks upon the Japanese cavalry. The mad rush made by the big fellows was not to be repulsed. The terrible weapons were thrust into men and horses; some of them stuck and could not be removed. An entire Japanese squadron was literally cut to pieces and when the Cossacks lost their lances in the fray, they seized the swords from wounded Japs and continued the fight.

While the Russians have many times shown gross brutality and have even mutilated the dead bodies of the enemy, rumors of such atrocities on the part of the Japanese have been very few. Russians who scoff at the Japanese soldier, however, are loud in the praise of the Japanese hospitals.

The work of the Japanese medical corps is carried on regardless of nationality, and many a wounded Russian has had the tenderest of care from the despised enemy. In many instances the food the Russians have been accustomed to has been afforded the patients. The Red Cross Society ship of the Japanese is splendidly equipped, and the women nurses are the equal of any in the world.

Before the Japanese make an important move they are fully informed of the lay of

The Cossacks Use Lances

Japanese Nurse Wounded Foes

Japanese Spies in Korea

Bandits Burn Telegraph Poles

the land before them by spies, of which they have a wonderful system. These spies note every detail and gather an incredible amount of information. Thus prepared the officers can command an advance with something of a certainty as to the conditions to be met.

The Chunchuses, Chinese bandits, are aiding the Japanese greatly. They are constantly harassing General Kuropatkin's forces and are retarding Russian movements in many ways. One of the great annoyances they delight in is twining telegraph posts with straw and setting them on fire.

Japanese outposts are extremely vigilant and are often accompanied by a dog which quickly scents the messenger stealing along so cautiously. Anyone the Japs catch stealing along the shore is immediately shot.

Russian officials are doing all in their power to make the war more popular among the people. Restlessness and grief pervade the empire and the poor peasants have little hope left when they have sent the strongest and best of their men to almost certain death.

Prints putting Russia in the most favorable light are being distributed throughout

Running the Gantlet--A Convict's Chance for Liberty

Liberty the reward for success;
Death the penalty for failure.

These are the alternatives offered one Russian convict each day at Port Arthur. Once in every 24 hours a courier is sent out in the effort to penetrate the Japanese lines and carry news to Kuropatkin of conditions in the beleaguered city. So alert are the Japs that only an occasional carrier gets through with his letters, written in cipher, and wins his reward in liberty, of which he had had little hope.

Much of the journey the poor wretches must make at night, for there are some points so dangerous that few escape. The

the country to give the impression that hers is the victorious army.

Two of these prints are shown here. One represents Russia as the spirit of peace, a dove with an olive branch resting on her uplifted hand, while in the other she holds a lily. Behind her stalks Japan in the garb of a fiend of darkness, bearing a knife and attended by the monsters of the deep. The other shows a group of Japanese officers before whom the spirit of the great Napoleon has just appeared. Consternation and horror are depicted on the officers' faces as the spirit says, "If my thunderbolt against Russia failed, what can

Prints the Russian Officials are Distributing Among the Peasants in the Effort to Make the War More Popular

The Hardships of the Russian Transport in Manchuria

yellow-faced dwarfs like you expect?" These prints are believed to have an appreciable effect on the minds of the people. Another stroke of policy in this line has just been made by the Czar in granting all persons suspected of conspiracy against the government, and the political prisoners, a right to trial the same as in other offenses, instead of, as formerly, banishing them to Siberia without trial. This sweeping reform will mean a great deal to the Russians and is apt to make them more kindly-disposed toward the ruling powers.

The Cossacks are extremely superstitious. Not one of them would antagonize the will of a priest for whom they entertain a great awe. Just before going into action a strange scene is enacted by the army so soon to go forth to fight and kill. A priest bearing a cross rides out before the troops. In an instant every head is bared and bowed, and over the restless battalion falls a great hush while the priest offers the prayer.

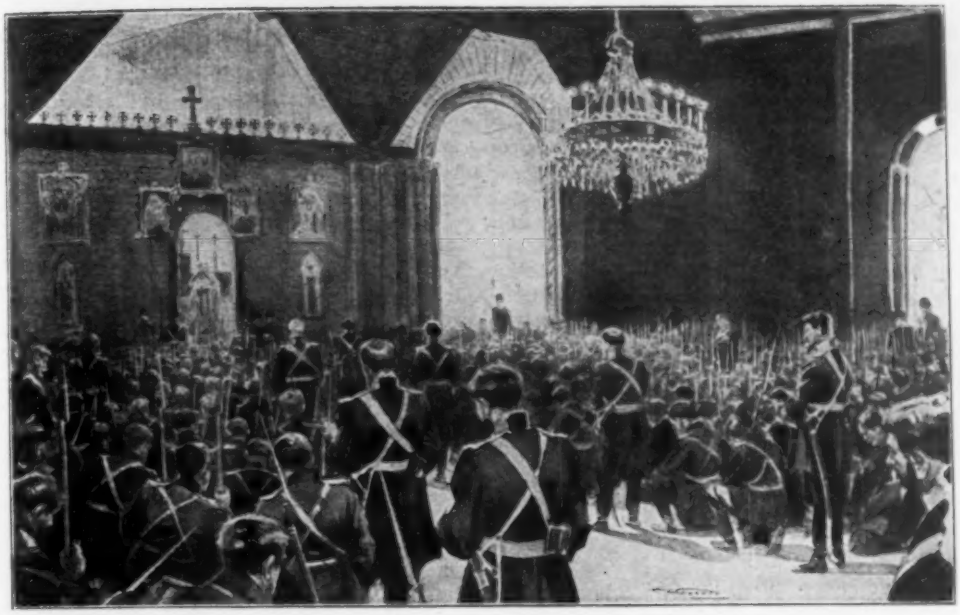
Wherever he is seen, boarding the train for the front, marching across the frozen expanses, on board a battleship or stopping of nights at cities while en route for the war, the Russian soldier is always devout. No conditions so uncomfortable, no place so cold, no landscape so dreary—and with all these things the Russian spirit much do battle—but he can turn a ready mind to devotional services.

When a trainload of soldiers stop at a town at the close of the day, on leaving the train they line up beside it, the bugles sound, and then with bared heads they stand while a priest reads the evening prayers. After this service their courage is further revived by singing popular Russian songs.

The illustration shows Russian soldiers worshiping in the church at the great city of Harbin. The military effect of the many bayonet points rising above the bowed and kneeling figures makes the scene remarkable in the extreme, and is significant of the nation's attitude toward its own religion.

"Over the Restless Battalion Falls a Great Hush While the Priest Offers a Prayer"

The breaking up of the cold weather brought greater difficulties for the Russian soldier to contend with. He was accustomed to the cold so that it was not a great hardship, but the deep mud which came with spring handicaps him at every turn. The roads in Manchuria are poorly constructed and the heavily loaded transport wagons sink hub-deep. To move a battery of artillery forward means a terrible struggle for both men and beasts and leaves them in a thoroughly exhausted condition.



Russian Soldiers on the Way to the Front Worshiping in the Church at Harbin. Even in the Poorest Districts of Russia, where the Peasants Live in Wretched Hovels, Beautiful and Costly Places of Worship are Erected

A Brave Charge up the Heights

In the fight which has been raging among the hills around Port Arthur the Japanese have made many brave charges up the steep heights. The Russians entrenched at the top of the hill have all the advantages of locality and only by great loss can the Japanese hope to dislodge them. Never faltering at the terrible prospect, with shells falling thick and fast among them and always advancing over the dead and wounded bodies of their comrades who have gone before, they have persisted until the heights were scaled and the enemy put to rout. Many pieces of Russian artillery have been captured after such a struggle.

DISASTER BEFALLS RUSSIA'S FINEST SUBMARINE BOAT.

With the carnage of war pressing closer around her, with bloodshed and losses and famine and defeat confronting her troops on every hand, on the peaceful river Neva, where the red fringes of the war have not yet reached, Russia has just beheld one of the worst tragedies the present war has brought her. In all previous history there has been but one like instance with the difference in that instance that none lived to tell the story, while in this a few survive who will remember the horror of that time all their lives.

The scene was in the Neva river where, just off the Baltic ship-building yards, lay moored the "Delfin," the finest submarine boat in Russia's navy. A detail of raw sailors and officers had trooped down to the wharf to learn something of the management of the deadly little craft which now figures so greatly in the fates of nations. Though far removed from the scene of the war, the atmosphere was thrilled with something of the spirit of that bloody conflict. The men were eager to board the boat, but the three officers hesitated; the captain was absent. The crew was experienced, however, and desire finally conquered any misgivings.

Laughing and jesting 32 men descended into the boat, though the "Delfin's" capacity was for but 10. As the last man entered a passing tug sent a great wave of water splashing into the interior. The inexperienced sailors were thrown into a panic. Already the submerging apartment was open and the crew were screwing down the manholes. One sailor made a desperate effort to escape and there was a rush of escaping air, a number of flying bodies hurled violently out through the manhole, and then, like a stone, to the river's bed sank the "Delfin," and with her went 21 men, 11 having been blown through the manhole and escaped with their lives! One of the officers who was thus saved, afterwards said:

"I remember a sickening sense of suffocation from the fumes of the storage batteries and then a rush of air and water; a flash of blinding light, and the next thing I knew was that I was ashore. What those who sank with her suffered I dare not think."

The "Delfin" was raised shortly afterwards.

THE GREAT ELIZABETH SUSPENSION BRIDGE, BUDAPEST.

After six years of incessant labor the great Elizabeth suspension bridge, crossing the Danube at Budapest, is opened to the public. There were no physical conditions which made the suspension type a necessity, and this style of construction was chosen chiefly on account of its symmetry and beauty. A short distance down the river is the old chain suspension bridge, the Lancz; while on the other side is Ferencz-Jozsef, a cantilever built to resemble a suspension bridge. The Elizabeth is 951 feet long in the main span, and of unusual strength. It carries a double track electric railway, and also has passageways for teams and pedestrians. The structural materials were produced at the government steel works, and the shops of the Hungarian State Railways. Only a few small details such as lamps and ornamental railings were furnished by private firms. The erection was by the Danube Bridge Department.

In England one must not leave his automobile with engine running, unattended in a street or public place. Violation of this rule is punished with arrest and fine.

Paris surgeons are using the cinematograph, or moving picture machine, for demonstrating to students the method of proceeding with typical surgical operations.

United States citizens drank 10 per cent more liquor in 1903 than 1902, or 3,623,913,194 gallons of stimulating drinks at a cost of $1,451,533,379.

Electrical Mosquito Destroying Apparatus

Insects Lured to Death by Sounds of Music

The introduction of petroleum oils for covering the surfaces of waters in low, marshy places where mosquitoes breed, promises to be superseded in some countries by systems of destroying the pests with electrically designed and driven contrivances. In the tropical countries this work, under the management of interested parties, has been carried on for a number of years and is steadily progressing.

Petroleum oil has been extensively utilized for the purpose of coating the waterways with a film of oil, as its odor tends to destroy the existence of the mosquito; but for various reasons, oils on the waters are not practicable in many instances. Other means have been devised. Smoke producing apparatus was utilized in some places and

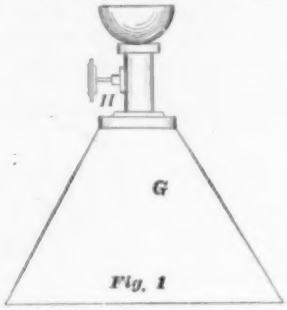


Fig. 1

the volumes of sulphur-laden smoke destroyed insect life within a certain radius; poisons of various kinds have likewise been employed in the science of mosquito destruction, and now up-to-date models of electrical devices have been designed both in America and foreign countries and employed for the purpose of destroying mosquito life in the lowlands, along the river banks, and in fact wherever the pest thrives. Fig. 1 gives a general idea of one of these devices.

What looks like a big lamp shade is made of sheet metal, painted white inside, black outside. The diameter at the lower edge is something like 3 feet. The shade tapers up to G and is connected to the electrical portions at H. In order to get an idea of the workings of the death-dealing affair, reference should be made to Fig. 2, where is shown the little magnetic coils I, I. This ponderous lamp shade, so called, is set up in proper contrivances on pole connection in pools, swamps, yards, or places where there are enough mosquitoes, and the proper electrical connections are made with the coil wires. The coils are about 1000 ohms resistance, with a vibrator, J, between their poles. A lightning globe is inserted at the

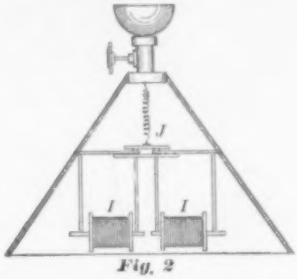


Fig. 2

upper portion of the shade and the bright light against the whitened surfaces is reflected strongly and attracts the unwary mosquito to his doom. The candlepower of the light is about 30. Another feature of the device is the erection of some fine wires inside the shade, arranged on the harp plan. These wires are caused to vibrate just enough to emit musical sounds. The music is soft, but it floats on the atmosphere for considerable distance on clear nights.

The buzzing sounds are very like that from the mosquito himself and the soft, enchanting music draws thousands of insects to the shade. Inside the shade a sticky surface, usually made of fly-paper, is arranged. Sometimes, instead of gummed fly-paper, portions of metallic surfaces are coated with a sticky composition on which the mosquito is pretty sure to fasten himself by legs or wings while wabbling about

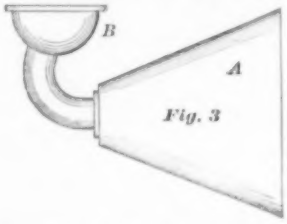


Fig. 3

with eyes dimmed by the strong light and with mind benumbed with the sweet strains of the harp cords. The result is that multitudes of the insects lose their lives in the shade and either remain therein, to be scraped out next morning by cleaners, or to

drop down to the earth of their own weight when dead. Underneath the device one sees numerous mosquito dead. The music attracts and stuns and causes death oftentimes. Some of the makers of the paralyz-

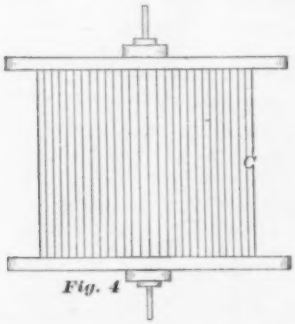


Fig. 4

ing devices use the shades in the manner exhibited in Fig. 3. The shade itself is designated A, and the connecting cup with the wiring is marked B. The construction of the musical sound-producing mechanism is shown in Fig. 4. It is made of a metallic frame across which is strung the set of fine steel wires C. The vibrations of these wires in mid-air, even if caused only by the drafts of wind blowing through, send forth an entrancing music that seems to attract the mosquito to the trap.

One of the oddest types of mosquito destroying contrivances lately devised is one in which the mosquitoes are sucked into the death trap, shown in Fig. 5. There is a cone-shaped tunnel made of wood, about 4 feet in diameter at the open end, tapering to about 3 feet at the base end, where the suction propeller is operated. The length of the cone tunnel is about 4½ feet. It is set up in places where mosquitoes congregate in

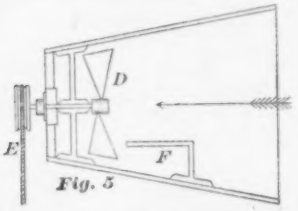


Fig. 5

numbers to breed. The propeller D is a suction wheel and so arranged that any light object like a mosquito coming near the open end of the cone is promptly sucked into the death-trap. The wheel is speedily revolved by the belt E on a wooden grooved wheel. The belt is operated by a motor below. This contrivance is fixed to a post at about the elevation of ordinary tree tops; F is a stand on which is placed poisonous material, the fumes of which rise into the nostrils of the mosquitoes which are so unluckly as to be drawn into the tunnel by the air suction. Soon after starting the affair, the mosquitoes accumulate and before the next morning the machine has, as a rule, piled the mosquito dead to a goodly height.

A SUGGESTION FOR PHOTOGRAPHERS.

Here is a method of timing exposures which is far more accurate than counting, which always varies in the time it takes with the individual who is doing it, and therefore cannot have a standard time value.

If the exposure is for one second, say "Naught, one half and one"; if for two seconds, say the same twice; if for a half-second, say "Naught, one-half" as rapidly as may be, and for a quarter-second, merely say "Quarter." It is almost impossible to say these words too quickly.

BABY INCUBATOR AT THE FAIR.

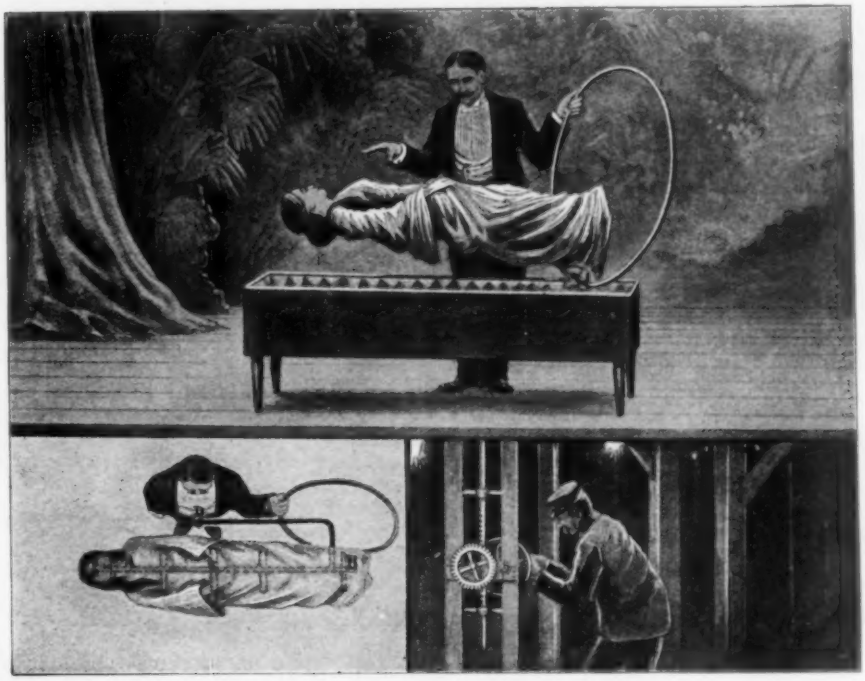
One of the most interesting exhibits at the St. Louis World's Fair is a baby incubator fully equipped, not only with all the apparatus and accessories necessary, but also with the frail, little new-born being whose chance for life is depending almost entirely on the care received through the incubator. A great many elements enter into the construction of a reliable incubator for nurturing human life. Not only must the temperature be kept at a certain degree, but sanitation, air and means of feeding all require a great deal of careful attention.

AN IMPROVEMENT FOR DYEING MACHINERY.

A German has just produced an invention which will work a radical change in dyeing machinery. In the method of dyeing in present use the goods pass at full width through a part called the jigger which contains the coloring liquid. The new invention does away with the reservoirs for mixing the dye and it is mixed in the vat instead, and then sprayed with great force upon the cloth by means of atomizers.

Mysterious Mechanical Stage Illusion

How a Seemingly Impossible Feat Is Performed



"Without Any Apparent Support, She Remains in the Air"

Theater goers in Europe are being puzzled over an illusion which the audience are unable to explain. When the curtain rises a mahogany box, to all appearances a coffin, is seen resting on four small wooden legs: behind it stands the magician. As he makes passes with his hands the motionless form of a beautiful young woman is seen to slowly rise from the coffin. Stretched at full length, and without any apparent support, she remains in the air while the performer passes a hoop the full length of the body, giving absolute evidence of no support below. After the hoop is removed in the reverse direction, the body slowly descends into the coffin and the curtain falls. The illustration explains how the trick is done. The body rests upon a steel framework (B) which is securely fastened to the iron which is fastened to an upright steel shaft at D. This shaft which is painted black does not show at a short distance, and is raised and lowered by a man below the stage.

AMERICA MAY BE EXCLUDED FROM THE WHALING INDUSTRY.

Two tons of whalebone were purchased in London recently at $15,000 per ton, and besides this the world has but four tons visible supply left. Now American whalers may lose their share in this profitable industry, for the Canadian government is endeavoring to exclude all but Canadian whalers from Hudson Bay.

American whalers have always met with great success in these waters, where the finest grade of whalebone is obtained. In 1902 one Yankee ship secured 7,000 pounds of whalebone, which was valued at $25,000. If Canada succeeds in her purpose only Canadian, English and Scotch whalers will have access to the Bay.

Armies Have Telephone Scouts

Among the most important points of a modern well equipped army is the use of telephone scouts The scout's duties under any circumstances are attended with great hazards, and yet his services are indispensable. Of old, he was frequently sent out on long trips to spy out the lay of the land and obtain all the information he could about the opposing forces, only to return to camp to be sent back for some important detail which new conditions had brought up or his officer's oversight had failed to emphasize. Once again he was obliged to make the perilous trip, from which, brave as he was, he had been glad to return, and often several trips were made before the information was satisfactory.

U. S. Telephone Detail Party—Conductor Paid Out From the Wagon.

Nowadays, when a scout starts out to find out all that observant eyes and a mind trained to military affairs can about the foe, he is accompanied by a man carrying a telephone instrument and paying out a single line of conductor as he goes, or sometimes the scout carries the telephone himself, though more frequently he gives his undivided attention to the field glass, dictating his observations to the telephonist, who transmits them to headquarters, where, if any orders are to be given, they can be given at once, or any questions asked and answered at once, and all the work necessary is included in the one trip. The attendant usually carries the reel of conductor and the batteries on his back until the site for the observations is reached.

A Telephone Scout Dictating to His Telephonist.

A ground return is used, the connection being made by striking a hatchet or bayonet into the ground and wrapping one end of the wire around the exposed part of it.

Sometimes the distance is so great that a wagon carries the reel of conductor as far as it dare go and then the scouting party proceeds alone. If the line is to be left in place, sometimes it is laid in protected places or attached to trees and other supports.

All great military powers use the telephone in this manner. In the present war the Japanese use it thus. It is also used for communication between

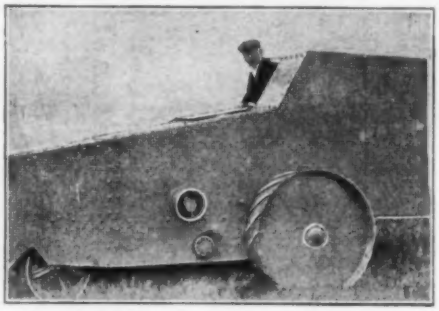
the often widely separated camps of an army. In each camp a special cordless switchboard and specially constructed telephone instruments are installed, says the American Telephone Journal, and are found to be of invaluable assistance in emergencies.

AN AUTOMOBILE HOSPITAL.

Built of Steel and Bullet-Proof, for Field Hospital Service.

To a young lieutenant in the British army credit is due for an invention which will be a boon to his wounded comrades in time of war and is another effective agency for ridding the battlefield of some of its horrors. During the Boer war the inventor was with the troops which met the most stubborn resistance and all around him fell comrades who, despite an efficient Red Cross corps, must lie there and suffer while the battle raged.

The invention consists of a bullet-proof motor for field ambulance work and is designed for the use of army medical officers and stretcher bearers on the field of battle. The mechanism of the machine is very



Bullet-Proof Hospital Automobile.

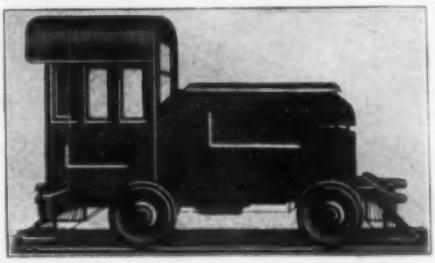
simple. The bullet-proof shields can be extended, wing fashion, to protect two sets of stretcher bearers in the firing-line. The motors are 3-wheeled and can be used for hospital traction or for driving ice-making machines for the field hospitals.

FORGING IRON SERIES REPRINTED

The series on "First Lessons at the Forge," which has been running as a serial in this magazine during the past few months, has been reprinted complete in pamphlet form and will be mailed to any address on receipt of 10 cents. Address Popular Mechanics.

GASOLINE LOCOMOTIVES BUILT FOR INTERURBAN SERVICE.

Gasoline engines and also gasoline motor cars are being built by a Kansas City company. The engine is of the vertical single



Gasoline Locomotive for Passenger Serivce.

cylinder four cycle type. A cam opens the exhaust valve and a vacuum formed by the descending piston opens the intake valve. It is water jacketed, a centrifugal pump driven from the main shaft circulating the water. The ignition is by means of an electric spark.

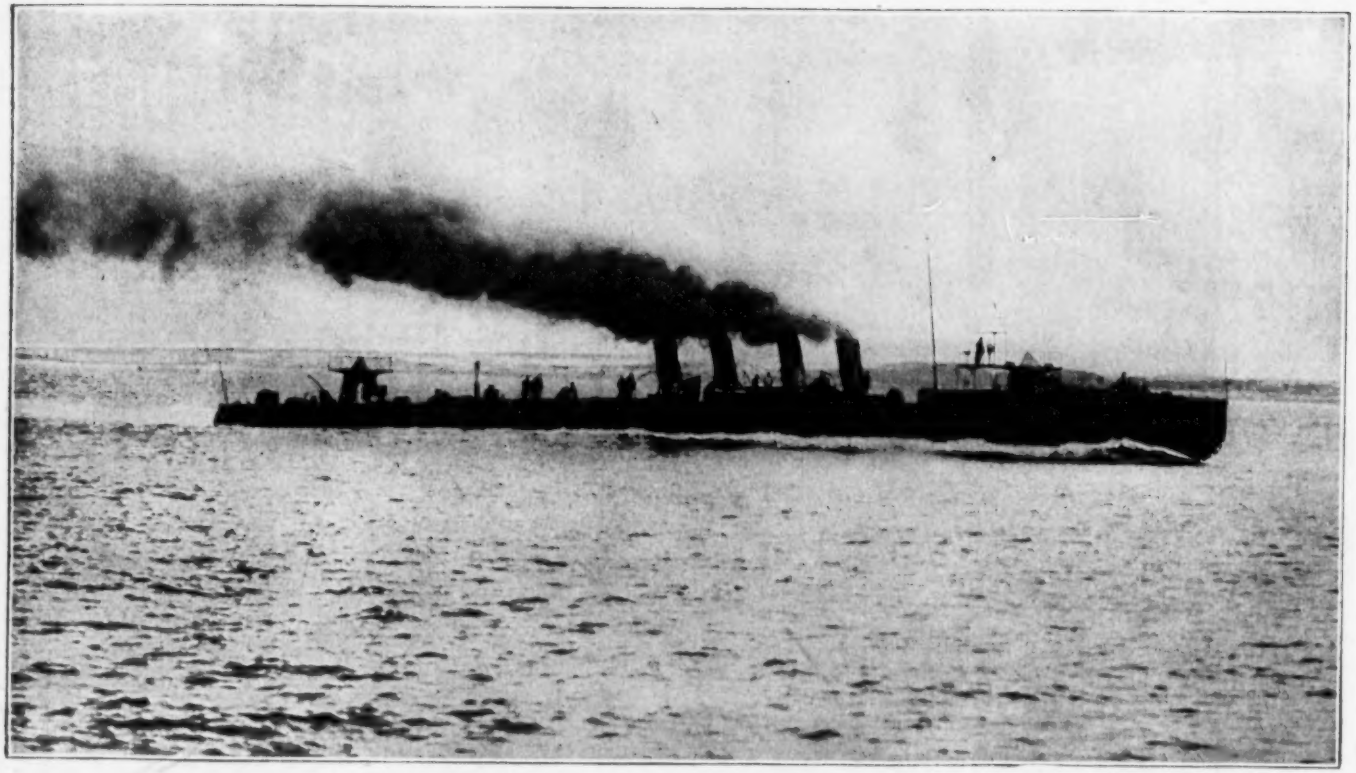
The engine runs continuously in one direction, and the power is transmitted to the wheels through a reversible clutch. This is so designed that the car is started and stopped smoothly and can be run in either direction while the engine runs continuously one way. The faces of the friction lock the driving gear by impingement. The clutch is on an intermediate shaft, which is geared to the driving shaft.

The weight is distributed to three points by making one support over the center of the axle and equalizing it across to the boxes.

The storage of gasoline is carried on the truck in a tank with walls over ½ inch thick. The gasoline is not fed by gravity, but is carried over by mechanical action only when the engine is moving. A lower grade of gasoline can be used, thus reducing the operating cost considerably.

In the gasoline motor passenger car one end of the body has a section of floor removed to accommodate the elevated part of the engine within. This is shut off from the passenger section by a partition.

Each of the locomotives has power enough to haul a passenger coach or interurban car at good speed It carries supplies for a 100-mile run and one man only in required to operate it.



Courtesy Journal American Naval Association

U. S. S. "Lawrence," Torpedo-Boat Destroyer, at a Speed of 31 2-5 Miles Per Hour.

In one of nine tests the "Lawrence" attained a speed of 33 3-4 miles, the speed required being about 30 miles. Her length over all is 246 feet 3 inches, beam 23 feet 3 inches, depth 19 feet 9 inches, displacement 400 tons. Her armament consists of two 3-inch semi-automatic rapid-fire guns, five 6-pounder semi-automatic rapid-fire guns, and two tubes for 18-inch Whitehead torpedoes.

Cleaning Streets with Compressed Air

No Brooms, No Dust and No Unsightly Machines

Machine at Work -- Left-Hand Valve and Nozzle Open

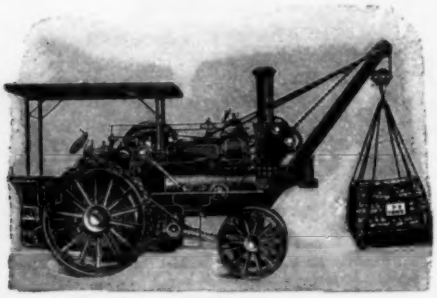
The street sweeping machine which for years has left clouds of dust in its wake, and hurled stones in all directions as it passed, will now have to go to the scrap heap, where it belongs. The new method is dustless, noiseless, and very much cheaper to operate. No sprinkling wagon is required to prepare the way: the new cleaner does its own sprinkling. Compressed air is the power and water is the

Center of Street Cleaned -- Washing Both Sides of a 32-Foot Roadway Clear to the Curb

medium with which the work is done. Two steel tanks are carried on each wagon; the larger for water, and a smaller tank contains the compressed air. When the driver moves a lever, the nozzles beneath the wagon are opened, and driven by the air, the water rushes out on either side, sweeping all dirt to the gutters. The force of the water is regulated by the driver, and cleans effectively for 30 to 40 feet on each side. The middle of the street is cleaned by another wagon which precedes. One supply of air is sufficient for several tanks of water, and when the air pressure is exhausted the tank is filled from a reservoir of compressed air carried on a supply wagon. There is practically nothing to wear out, the first cost is much less than the revolving-broom wagons, and the expense of compressing the air is comparatively small.

SELF PROPELLING CRANE.

A steam crane for heavy work around docks and in factory yards is being built in France. The new crane utilizes the usual features of the traction engine, with the



Traction Crane

addition of a derrick carried at the front end and operated by the machine's own power. The outfit can be run to whatever place it is needed and saves the work of many men.

The United States may have a national naval abbey in which the deeds of her naval heroes will be sacredly commemorated in a manner calculated to inspire the youth of the country with high resolves. The government has appropriated $10,000,000 for enlarging the naval academy at Annapolis and the chapel which is one of the new buildings may be used for this purpose.

NEW GUN THROWS A LINE LONG DISTANCE.

A new gun for throwing lines for life-saving purposes will throw a line from 200 to 400 feet, the distance varying with the force of the wind, with great accuracy and without the operator moving from his seat.

Lyle Line-Throwing Shoulder Gun

These Lyle line-throwing shoulder guns are equipped with a wooden box, 32 by 12 by 5 inches, containing four projectiles, standard size blank cartridges, cleaning rod, etc.

The guns are so small and compact that they can be easily used from almost any size craft, throwing the line to a vessel by which a hawser may then be sent aboard. They have many points which will make them rank high among life-saving devices.

CARRY MAIL IN MOTOR OMNIBUSES.

Motor omnibuses are now used in sparsely settled districts of England for carrying mail. The omnibus system was put in by a railway company to serve as a feeder to its line, and in time proved itself so adequate to meet the conditions and so much better than fixed lines of railway that the Postmaster-General decided to make use of it for the distribution of mail.

The 'bus system includes both passenger and luggage compartments. The passenger compartment seats 10 persons and the luggage van, in case of need, can be converted into an additional compartment for passengers. When used for luggage only, a ton of parcels and baggage of all kinds can be stowed away within it, and more can be placed on the roof. Passengers are taken up en route, and when the passenger compartment is overtaxed the luggage space is given up for their accommodation, parcels, boxes, etc., being left for the next van in preference to a passenger, though, of course, the mail bags are never left behind. The system has been so satisfactory that a number of new motor omnibuses have been ordered.

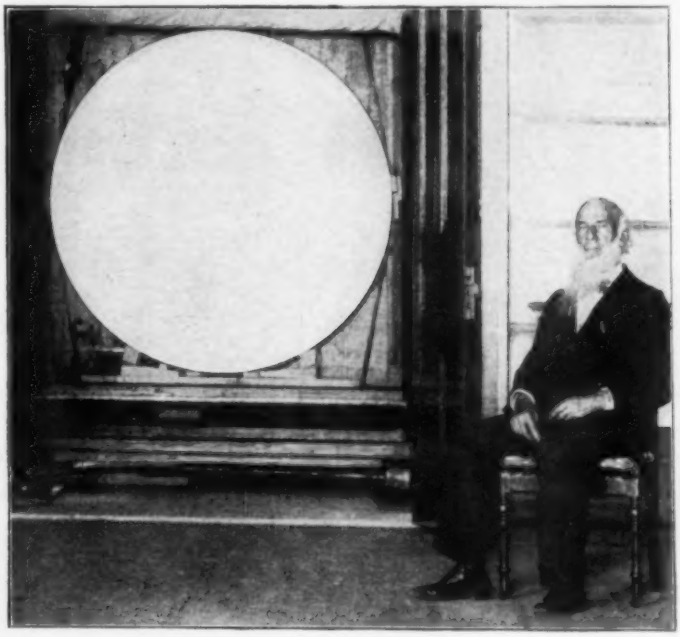
Show "Pop" to your friends.

Largest Lens In The World

Cost $100,000--Makes a Hair Visible 300 Feet Distant--Important Discoveries Expected From Its Use

At the American University, Washington, D. C., an observatory is soon to be built and the great reflecting lens of the late Rev. John Peate mounted and placed therein at a cost of $100,000. Great things are expected of this lens when mounted, it having been declared upon its completion in 1898 to be the largest in the world. Its diameter is 62 inches and it is 5⅝ inches in thickness.

The maker of this lens took up the study of the methods of polishing glass late in life. In all he made 16 fine lenses, some of which are now in use in distant lands. He was past 75 years of age when he made his greatest lens—the one for the American University. It was no easy task to find a glass manufactory that would undertake to cast a 62-inch lens. Five times the molten



A Great Lens and Its Maker

glass had to be poured into the mold before a perfect result was obtained. Before being polished the casting weighed a ton. When completed its weight was 1,500 pounds. Three months were required for the operations of polishing. Rev. Peate in his work used an enormous grinder which he himself manufactured. In all, two years were required to make his famous lens.

At present it stands in the corridor of the College of History at the American University.

After its completion, in the workshop of Rev. Mr. Peate, Greenville, Pa., it was tested before being sent to Washington. A dial the size of an ordinary watch was placed 100 yards distant from the big lens. A word was written upon its face with a lead pencil. A pin was placed in the center of the dial and a hair was used as a hand. Dr. Peate's lens magnified this dial 10,000 diameters, every part of the dial being prominent. Though unmounted, by its use, it is said, that Dr. Peate was enabled to detect stars which never before were visible.

Despite the fact that last year, in many European districts, beet sugar was sold at an absolute loss, Europe now has 3,861,861 acres sown to sugar beets and it is expected that this acreage will yield 5,520,000 tons of beet sugar. A great deal of old sugar is on the market.

LATEST WIRELESS TELEGRAPHY TOWER

The Tesla central power plant and transmission tower for the transmission of wireless world telegraphy is nearing completion.

Tesla Central Power Plant and Transmitting Tower

It is located at Wardenclyffe, Long Island, N. Y., is a pyramidal tower having eight sides, is 185 feet high and emits a transmission wave complex of a total maximum activity of 10,000,000 horsepower, so say its promoters, one per cent of which will circle the globe.

This is but the first of a number of towers which are to be scattered over the world, each near some great center of civilization for the transmission of World Telegraphy. Each such tower, it is said, can operate hundreds of millions of pocket-size instruments which can be set up anywhere on ocean, mountain, or desert plain and there will receive any messages intended for it and the news of the world. The entire population of the world will then be in direct commuunication. What would such an instrument have been to Livingstone when he took those long, dangerous journeys into the interior of Africa, or to Robinson Crusoe on the desert island! What a boon, when the system is in perfect working order, as it undoubtedly soon will be, to ice-imprisoned Alaskans or vessels at sea! What an important part it will play in military tactics! and who will have the best of the game? Too bad it was invented after everything else but the North Pole had been discovered.

TRAVELING POSTOFFICE IN ITALY.

The leading cities of Italy are now equipped with automobile postoffices which run on regular schedules. Stops are made at prominent places where the office opens for business, selling stamps, registering valuable letters, and selling money orders.

Italian Automobile Postoffice

Letters can also be mailed, and runs to the main postoffice are made at frequent intervals.

ENGINE "999" NOW HAULS A MILK TRAIN.

The famous engine "999" which was the pride locomotive exhibit at the Columbian Exposition and broke the record for fast time when it drew the Empire State Express across the continent at a high rate of speed, now hauls a milk train at the rate of 17 miles, between Messena and Utica, New York.

NEWS PUT IN TYPE WHILE IT IS HAPPENING.

While on the football field cheers and cries of encouragement rang out now for one team, now for the other, miles away in the printing office of the Daily Press of Ashland, Wis., a linotype operator was setting up the story of each play as it was made as though he were an eye witness of the game and without a moment's delay. Even as the game was finished, bulletin boards announcing its outcome were posted and the story in detail was being rushed to the presses to come out in an incredibly short time.

Receiving Copy by Telephone

Telephony accomplished these results. A reporter had a well located booth at the ball grounds and told the story over the telephone to the operator of the type-setting machine, who had a telephone receiver fastened to his ears and who set up the words as fast as they were spoken to him. Of course, the circuit was private for the time being, so that no other paper could "scoop" the news. In this way the paper manages to get the latest news out in the shortest possible time. Much depends on the alert, observant eyes of the reporter and the quick ears and ready mind of the linotype operator. News so received cannot fail to be accurate and shows the marvelous power of the human brain to receive ofttimes the most startling intelligence and at the same time control the hands.

PRESERVING TREES HAVING HOLLOW TRUNKS.

If a valuable shade or orchard tree is injured so as to cause a cavity, remove all decaying material from the cavity, using a chisel, until sound wood is exposed. Then mix a thin mortar of one part Portland cement to three parts clean sharp sand and fill the cavity with it. Let it become stiff, but not hard, and then coat the surface with a mixture of one part sand and one part cement so that all the moisture will be excluded from the cavity.

It is well to treat the inside of the cavity with a solution of one pound of copper-sulphate to five gallons of water after the decayed material has been removed and just before pouring in the cement.

SCRAP LEAD ROOFS.

The use of lead for roofs is coming more and more into favor and it is capable of the most beautiful architectural effects. It is most suitable for low flattish roofs, and is adapted to highly decorative designs. Scrap lead, because it contains a small amount of tin, or antimony, and does not readily corrode, is much better for the purpose than pure lead, which soon becomes covered with a white coating.

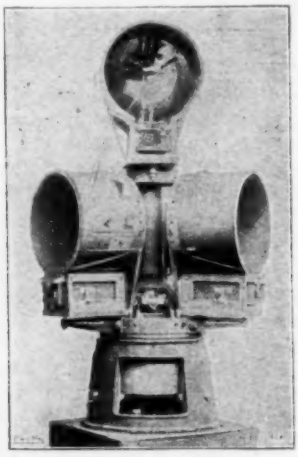
Send $3 and receive Popular Mechanics for 60 months.

Electric Lights for Lighthouses

Electricity is superseding the oil lamp for lighthouse purposes just as it is supplanting gas and oil and steam for many other purposes. Many of the modern and prominent lighthouses on the coast are now equipped with the electric light.

Among the most modern and finest of these is the new lighthouse at Heligoland at the entrance of the Elbe river, Germany. Two hundred and seventy feet above high water mark it stands and flashes its powerful light far out over the waters. It emits a total light of over 30,000,000 candlepower and mariners recognize it by its flashes of one-tenth second duration, emitted every five seconds. At a height of 12 feet it is visible 25 miles from the lighthouse.

Two hundred and twenty yards from the lighthouse is a small station equipped with two steam dynamos, one for reserve, the other for regular use. From this place the current for the lights is supplied. In a room directly below the lantern is located the switching apparatus. Each of the three lamps are supplied with a direct current of 34 amperes. Three reflectors, 30 inches in diameter, and placed at an angle of 120 degrees, are mounted on a platform, which completes a revolution every 15 seconds; this arrangement regulates the 1/10-second flash.



Three Complete Lamps for the Lighthouse

The platform is supported on a ring of steel balls of large diameter, this does away with the vertical axis formerly used for holding the platform in a horizontal position, and the space the axis would otherwise occupy is used for electrical connections. Six mercury contacts convey the current to the lamps and to the motor which rotates the platform. These contacts are ring-shaped iron basins filled with mercury and insulated from each other by pieces of mica. On the rotating platform are switches which dip into the basins of mercury and are connected to terminals which lead to the machinery.

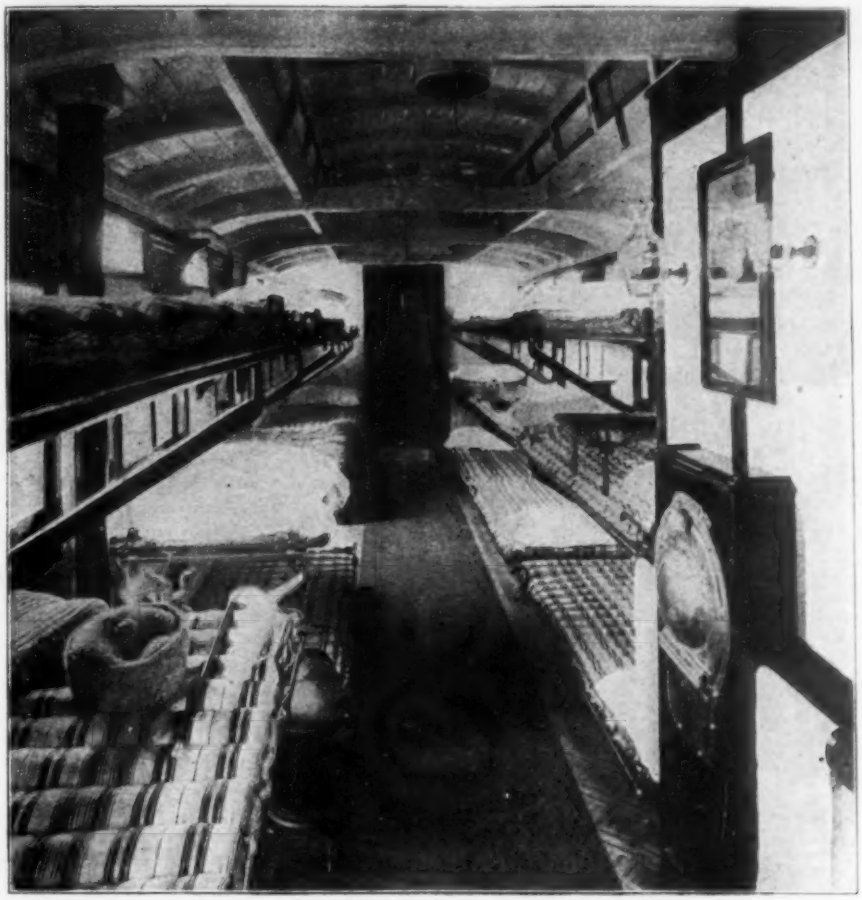
Heligoland Lighthouse at Night

The reflectors are paraboloidal and have a focal length of about 10 inches; within this focal length the arc must always be kept and to insure this, small lenses and mirrors are placed so they will throw the image of the arc on the pieces of opal glass which are mounted on the reflector case. The position of the arc is adjusted by vertical and horizontal marks on these pieces of opal glass, the horizontal line passing through the center of both carbons and the vertical line through the tip of the positive crater. Lighthouse reflectors are now made of glass, coated with silver.

An English automobilist made a run of 2,068 miles in 106 hours running time, part of the trip being over the Grampian Hills. "My father," was not feeding any flocks at the time, as the run over the Hills was made about midnight, including as diversion going off a bridge into four feet of water.

Finest Hospital Train Ever Built

The handsomest hospital train in the world was built during the Boer war by the English contributions, chiefly from the town of Windsor, the Central British Red Cross Committee and the Princess Christian, after whom the train was named because of her great interest in the venture. This



Hospital Train Beds for Wounded Soldiers

magnificent train, which consists of seven vestibule cars, each 36 feet long and 8 feet wide, with continuous passages through them, and perfectly equipped in all its various departments to give the quickest and most efficient help to sick and wounded soldiers, was built in the short time of 10 weeks, says the American Inventor.

Car No. 1 is divided into three compartments, one for linen and stores, another for two invalid officers and the third for two nurses. Car No. 2 has one compartment for two medical officers, another for a dining-room for the staff and one other for a dispensary. Cars Nos. 3, 4, 5 and 6 are arranged with three tiers of iron brackets on each side with wire netting to support hair mattresses and will each accommodate 18 patients. Pulleys are arranged in the roofs of the cars for lifting the beds with the patients on them to the height where they can be easily placed on the iron brackets. Car No. 7 contains the conductors' quarters, a kitchen and berth for the cooks, and each of the cars has a closet, a lavatory, lockers for stores and a tank for water.

The train carries at its head two flags, the

Union Jack and the Red Cross. On its center panel at each side is painted a large Red Cross on a white ground, encircled by the name of the car, "Princess Christian Hospital Train," in royal blue and gold. The train is provisioned and equipped and is commodious enough to maintain 97 persons two or three weeks. In its first five weeks of service 70 invalid officers, seven sick nursing sisters and 875 non-commissioned officers were brought from hospitals along the railway lines into Durban without an accident of any kind.

A hospital train built along the same lines is now going into service on the Trans-Siberian railway.

A CHAIR MADE IN ONE PIECE.

A native of South Africa, who had never made use of chairs, but had seen settlers use them, succeeded in making one of the most unique chairs in the world, says The Furniture Journal. To his untutored mind

A Chair Without a Joint

the idea that chairs were made of parts joined together never occurred, and wishing to possess one, he laboriously cut it out of a solid block of wood. When finished, there was the right form, the same serviceable article, but without a joint of any kind.

A PORTABLE PNEUMATIC JIB CRANE.

A large traction company of Cleveland, Ohio, has in use a portable pneumatic jib crane for handling trucks, wheels and oth-

A Portable Pneumatic Jib Crane

er general hoisting. The crane is mounted on a single truck with a lengthened wheel base and is propelled by two electric motors, mounted outside the axles so that the crane can be used both in the shops and on the road. It is furnished with a self-contained air compressor and thus all the hoisting, revolving and racking is done pneumatically. The crane has a lifting capacity of five tons

TYPEWRITTEN MUSIC.

The latest thing in typewriters is a machine which will eliminate all the tedious labor of preparing music for publication and will eventually reduce the cost of copies of music of limited circulation.

The new machine is much like other typewriters, except that it forms the scale as the operator proceeds, besides registering the characters. It not only registers the notes, bars and rests, but also marks the lines at the same time. A single machine sells for $300 at present and a company with $200,000 capital has been formed. Probably the next improvement will be a means of attaching the typewriter to the piano so that, as the great musician improvises, the music will be typewritten simultaneously, and without intruding on the inspired moment.

Popular Mechanics five years for three dollars.

French Auto Street Sprinkler.

AUTOMOBILE STREET SPRINKLER.

Auto watering carts are now being used in Paris. The carts are driven by 35-horsepower steam engines, have a capacity of 264 gallons and can be filled in six minutes. The water is sprayed by means of a pump driven by the rear wheels which arrangement regulates the delivery exactly in proportion to the speed of the vehicle. The spraying nozzles are adjustable, according to the weather, by the hand wheels projecting back of them. The two nozzles spray to the width of 25 feet. The cart has a maximum speed of nine miles, but the average is five miles.

HOW TO PRINT PHOTOGRAPHS ON GLASS OR CHINA.

Rose bowls, placques, fruit plates and numberless other glass or china articles can be prettily decorated with pictures by the amateur who is willing to exercise a little care. Familiar scenes and faces are the most suited to this work and the article thus decorated makes a pretty gift for a friend.

For flat surfaces plates will do very well for this work, says a correspondent of the American Amateur Photographer, but for rounded surfaces film negatives must be used. The object to be decorated and the tint of the print should harmonize.

Coat the article with a gelatine solution applied with a flat brush. Make a sensitizing agent of 6 drams red prussiate of potash and 4 ounces of water, shaking them well together, and placing in a dark room until thoroughly dissolved. In a separate bottle mix 7½ drams citrate of iron and ammonia and 5 ounces of water. When both solutions are thoroughly dissolved take equal parts of each, place in a bottle and shake together. With this solution coat that part of the gelatined surface where the picture is to be printed and leave in a dark room until thoroughly dry.

When it is dry fasten the negative in place by means of adhesive tape, rubber bands or anything which will hold it firmly in contact with the surface, and print in strong sunlight for half an hour, not disturbing the film in the meantime. At the end of the half-hour remove the film and wash the glass 15 minutes in clear water. This process will give a beautiful blue print, and the article bearing it may even be washed carefully in cool water.

Brownish or dark tints may be had by substituting the following sensitizer: 50 grains silver nitrate dissolved in 1 ounce of water.

FUEL OIL FOR NAVAL USE.

The use of fuel oil for marine purposes has been declared practicable by the liquid fuel board of the navy, which has been conducting tests in this line for the past 28 months. The board reports that no trouble in burning oil in a uniform manner will be experienced by an intelligent foreroom force, but that a liquid fuel system, which will not permit of a return to the use of coal within 24 hours, should be installed on no ship.

Wireless Telegraphy On Board Ship

By Guglielmo Marconi

The first daily newspaper published by means of wireless telegraphy in mid-Atlantic waters, the news of the hour being winged over thousands of miles of ocean expanse, was in all respects a success such as would satisfy the hopes and desires of the most sanguine inventor.

On board the Cunard liner "Campania," voyaging from Liverpool to New York, messages were sent to and received from both sides of the Atlantic, and at all times the vessel, which, ordinarily, would have sailed into port unknowing what news of good or ill awaited her, was in touch with all the events of general interest which were transpiring. Had she caught fire, collided with another vessel, or foundered in mid-ocean, news of her peril could easily have been sped to either continent, but no help could have been sent her, for no other vessel on the waters, unless it had instruments keyed exactly as the ones we were using, could have taken a message, and to key them like ours would have been almost impossible.

The voyage was taken for the purpose of testing a combination of the best points of four keys, the new instrument used having the greatest range of anything of its kind ever made. My stateroom was on the port side of the vessel and in it I installed my key, with the wires running to the truck of the foremast. On leaving Liverpool the vessel was put in communication with the shore stations at Poldhu, Crookhaven and Seaforth Sands. The distance traveled was 3,636 miles. We kept in communication with Poldhu for 1,700 miles, which is more than half seas over, and then we started on Cape Breton, and kept talking to that place during the rest of the voyage. So we were in communication all the way over. Everything sent to the land stations was received, and the only mistake made was in the name of Gen. Sir H. C. Wilkinson, a passenger on the "Campania," whose name at a distance of 1,000 miles was received "Wilson."

Nothing speaks more for the success of the test than the fact that contracts have been entered into to install instruments, both for sending and receiving messages, on all the vessels of the Cunard line.

My next experiment will be that of girdling the globe by means of instruments on vessels at sea. The British government has placed several of its warships at my disposal, and the next three months will be devoted to fitting them with the long-distance keys and receivers. Then they will be stationed at different points around the world, and I shall try to pick each one up in succession.

ELEPHANT AIDS LINEMEN.

While installing a new telegraph span in Assam, India, H. Hervey, former government telegraph inspector of India, was furnished with two enormous elephants to help carry on the work in the dense jungles where these were the only beasts of any practical value. There were many spanned rivers in the territory, great bundles of bamboo from 60 to 80 feet high being used, which were most awkward and wobbly and could only be held in position by means of many guys.

When the force were putting the last touches on a new span one night, the line broke and fell into the water, where it sank into the sandy bed, so that when the end had been recovered, hoisted on to the mast, hand-dragged as near to the check post as possible and the straining tackle applied, the rope could not be moved. Every person near lent his aid at hauling, but to no avail. Then the elephant man who had charge of the huge tusker, Tomboy, suggested putting the elephant at the task. The animal understood the instructions given him, seized the wire with his trunk and backed away, drawing the line out of the water. As soon as the wire left the water, the signals given over it from a distant station gave the elephant a series of electric shocks, so that he winced, but did not let go his hold until the wire was safely on the tackle.

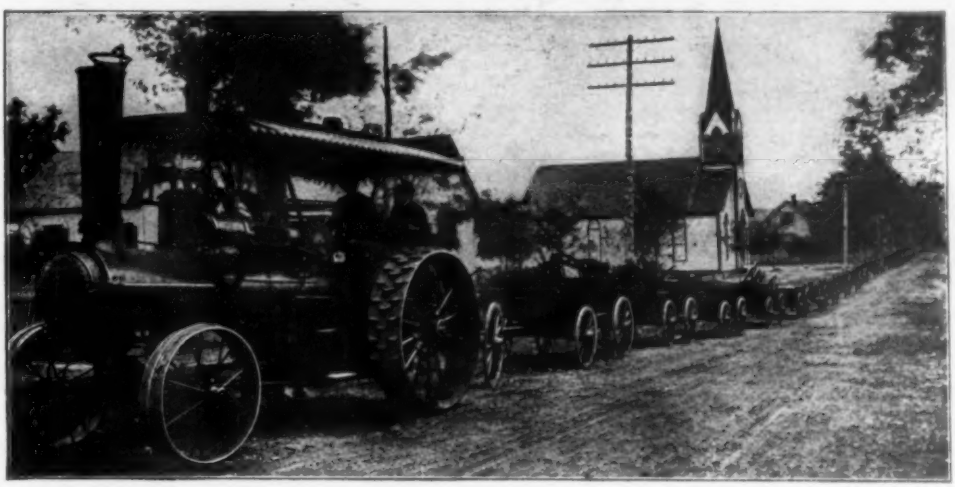
INK FOR WRITING ON GLASS.

A good ink for writing on glass is given by the Photo-Beacon. Dissolve 60 grains of shellac in 1 ounce of alcohol and, separately, 90 grains of borax in 1½ ounces of water. Mix the two solutions gradually, almost drop by drop, and if a deposit forms, heat at once. Then add enough aniline dye of any color desired to give it density. The amount of water used is an important factor and should be just enough to make the ink flow easily from the pen.

TRACTION ENGINE DRAWS A LONG TRAIN OF WAGONS.

A shipment of 30 wagons, weighing 26,950 pounds to be delivered from a railway station to a warehouse six miles distant:—How much labor is involved, how many horses will be required, and how many hours will it take to do the work?

Two men can do it two hours. At least that is what Roy & Jones of Alexandria, Tenn., did. The wagons were set up and coupled together and then, over the peaceful country roads which had never before known a like event, the train, nearly a quarter of a mile long, was drawn by a



Delivering a Train of Wagons from the Station to the Warehouse.

14-horsepower traction engine. Only once in the entire trip was it necessary to uncouple any of the wagons, a bend in the road causing the stop. The road was macadamized and in fine condition.

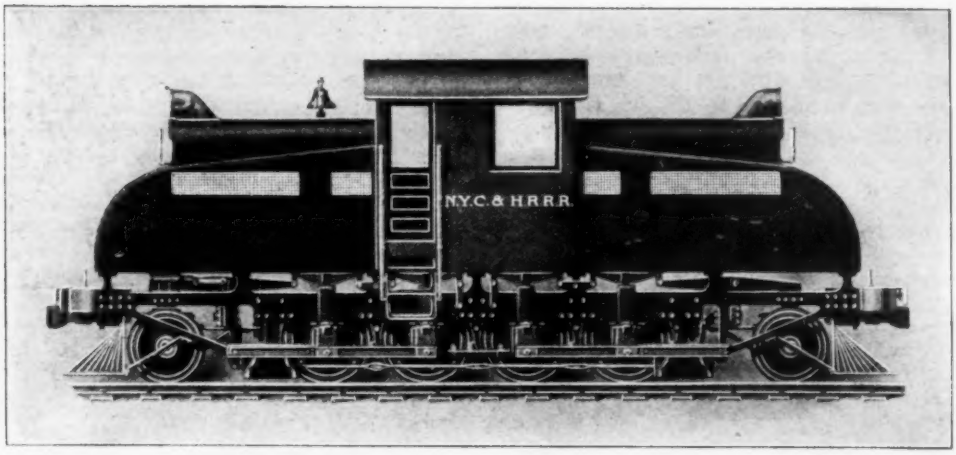
NOTED AUTHORITY DECLARES AGAINST THE TURBINE.

Rear Admiral George W. Melville, U. S. N., says the steam turbine is 20 years ahead of its time. That while it may be efficient for high speed machinery it is too leaky for propulsion, where the speed of the revolution may vary from 90 to 120 turns per minute. Engineers of prominence everywhere are unanimous in declaring that the Admiral has made a mistake. Fresh from an extended tour of observation in other countries, he still holds to the old form of reciprocating engine as best for ship purposes. As head of the Naval Bureau the Admiral has for many years promoted the use of this type of engine. The American Shipbuilder says:

"The Admiral's attitude toward the turbine is distinctly unfortunate for his reputation and is somewhat similar to that which opened the eyes of engineers to the limitations of Edison, who, when at the height of his popularity years ago, stated that a dynamo's greatest economy could not exceed fifty per cent. Edison's assertion was so quickly and widely challenged that his company was forced to discard his ideas, and to call in outside talent to revise the output, in order to save the entire business from going to wreck through the sudden revulsion of sentiment on the discovery of his ignorance of the principles of design." And again:

"Does any sane person believe that the most conservative steamship company in Great Britain would 'gamble' away six million dollars upon an experiment in building steamships with turbine engines? Not much! The Cunard people are no fools; they know exactly what they are doing, and the engineering world will run riot in its eagerness to equip new steamships with turbine engines after the Cunard company's first mammoth turbine ship makes her maiden trip to New York."

Electric Locomotives for a New York Line



Electric Locomotive for the New York Central & Hudson River R. R.

All the great electrical manufacturing companies both in America and abroad sent in bids for the construction of the electric locomotives which are now being built for the New York Central and Hudson River Railroad and the result is that the new locomotives promise to be remarkable features in this line of electrical construction and to surpass any engine yet placed on rails and will interest all great railroad companies.

The company required that the successful bidder (the General Electric Company and the American Locomotive Company) should produce a locomotive capable of making two regular successive trips of one hour each between Grand Central Station and Croton, a distance of 34 miles, with a total train weight of 550 tons, a single stop in each direction and a lay-over not to exceed 20 minutes. In addition to this it was provided that a similar schedule should be maintained with somewhat lighter trains making more frequent stops. Finally, it was provided that with a total train weight of 435 tons, the electric locomotive should be able to run from Grand Central Station to Croton without stop in 44 minutes, and, with one hour lay-over, be able to keep up this service continuously. This last schedule is the equivalent of the present timing of the Empire State Express, though the latter has a somewhat lighter train.

The contractors chose the direct current type of locomotive because it had shown itself reliable, but made a radical departure from all precedent in the use of bipolar gearless motors, the magnetic circuit, the field windings and the motor poles being integral with the locomotive frame and supported by springs. Four of these 600-volt direct current gearless motors of 550 horsepower each are to be used for the driving power, giving the locomotive a maximum rating of 2,800 horsepower, 50 per cent greater than the largest steam passenger locomotives of the present time.

One of these locomotives will measure 37 feet in length with a total wheel base 27 feet in length. The diameter of the driving wheels will be 44 inches and of the truck wheels, 36 inches. The driving axles will be 8½ inches in diameter. The locomotive will be a double ender and will weigh about 190,000 pounds. The journal boxes and axles will be so designed as to permit the engine to make curves of 230 degrees radius.

About 17,000 pounds weight will rest upon each of the driving wheels. The usual accessories of a steam locomotive, such as a bell, whistle, etc., and also an electric headlight at each end, will be provided. It is expected that with a light train these locomotives will give a speed of 75 miles per hour.

MECHANICS FOR YOUNG AMERICA

How To Build An Imitation Street Car Line

An imitation street car line may sound like a big undertaking, but, in fact, it is one of the easiest things a boy can construct, does not take much time and the expense is not great. A boy who lives on a farm can find many fine places to run

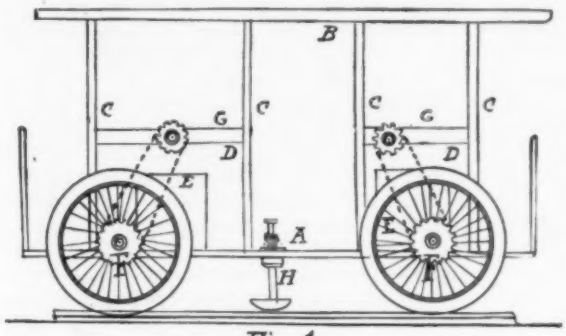


Fig. 1

such a line, and one in town can have a line between the house and the barn, if they are some distance apart.

Often all the boards and blocks required can be had for helping a carpenter clear away the rubbish around a new building. Wheels and parts of old bicycles, which can be used in so many ways, can be found at a junk shop at very low prices, wheels in good repair costing about 25 cents each. For the car for the street car line try to find a set of wheels having axles, but if you cannot find such, make shafts of hard wood, about 3 inches by 2½ inches and by

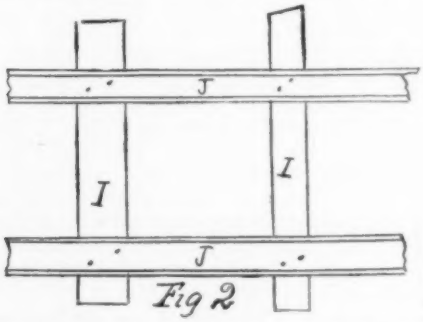


Fig 2

means of a jackknife turn, or shave down the ends to receive the hub bearings of the wheels. Fasten the wheel hubs securely over the ends of the wood with pins or little bolts, or if the wheel bearing is of such a nature that it revolves on its own journal, the journal can be fastened to the end of the wood piece. Each of the wheels should be provided with a sprocket; any chain sprocket of a bicycle may be used. Fasten these sprockets on the outside of the wheels as at F, F, Fig. 1. They can be set on over the bearing end and secured with a set screw, or the original key can be employed. It is best in cases like this to use the original parts. Make the floor of the car of pieces of boards placed on the axles and nailed, screwed or bolted, as shown at A. To erect the frame, place uprights C, C, C, C in position as shown, fastening the ends to the base-boards, and making the roof line as at B, then put in the cross pieces G, G. Seats E, E, are simply boxes. The drive of the car is effected by using the driving sprockets D, D, fitted to the crosspieces G, G, with the original bearings. The parts are thereby secured to the car and the chain placed on.

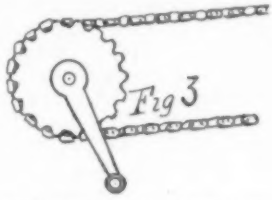


Fig 3

Key the cranks for turning to the upper sprocket's shaft and all is ready. If there are sprocket gears and cranks on either side, four boys may propel the car at one time. Considerable speed can be made on smooth roads, but it is the best amusement to run a car line on wooden tracks with a brake consisting of a piece of wooden shaft, passing through a bore in the car floor, and fitted with a leather covered pad as at H. A spiral spring holds up the brake until pressure is appled by foot power, when the brake contacts with the wooden track and checks the car.

The track plan is illustrated in Fig. 2. Get some boards and place them end for end on other pieces set as ties. The main

boards or tracks J, J can be about 6 inches wide, to the edges of which nail strips about ¾ of an inch wide and about the same height. The ties I, I can be almost any box boards. Wire nails are the best to use in putting the tracks together. The sprocket connection with the chain is shown in Fig. 3. This consists of the sprocket gear on the propelling shaft, and the crank. The pedals may be removed and a chisel handle, or any tool handle, substituted, so as to afford means for turning the crank by hand power. Great fun can be had with the road, and, furthermore, it can be made renumerative, as boys and girls can be given rides for a penny each.

How To Make a Water Bicycle

Water bicycles afford fine sport, and, like many another device boys make, can be made of material often cast off by other people as rubbish. The principal material necessary for the construction of a water

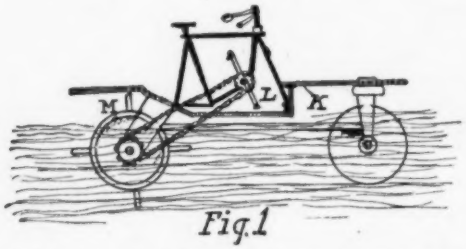


Fig.1

bicycle is oil barrels. Flour barrels will not do—they are not strong enough, nor can they be made perfectly airtight. The grocer can furnish you with oil barrels at a very small cost, probably let you have them for making a few deliveries for him. Three barrels are required for the water bicycle, although it can be made with but two. Figure 1 shows the method of arranging the barrels; after the manner of bicycle wheels.

Procure an old bicycle frame and make for it a board platform about 3 feet wide at the rear end and tapering to about 2 feet at the front, using cleats to hold the board frame, as shown at the shaded portion K. The construction of the barrel part is shown in Fig. 2. Bore holes in the center of the heads of the two rear barrels and also in the heads of the first barrel and put a shaft of wood through the rear barrels and one through the front barrel, adjusting the side pieces to the shafts, as indicated.

Next place the platform of the bicycle frame and connections thereon. Going back to Fig. 1 we see that the driving chain passes from the sprocket driver L of the bicycle frame to the place downward between the slits in the platform to the driven sprocket on the shaft between the two barrels. Thus a center drive is made. The rear barrels are fitted with paddles as at M, consisting of four pieces of board nailed and cleated about the circumference of the barrels, as shown in Fig. 1.

The new craft is now ready for a first voyage. To propel it, seat yourself on the bicycle seat, feet on the pedals, just as you would were you on a bicycle out in the street. The steering is effected by simply bending the body to the right or left, which causes the craft to dip to the inclined side and the affair turns in the dipped direction. The speed is slow at first, but increases as the force is generated and as one becomes familiar with the working of the affair. There is no danger, as the airtight barrels cannot possibly sink.

Another mode of putting together the set of barrels, using one large one in the rear

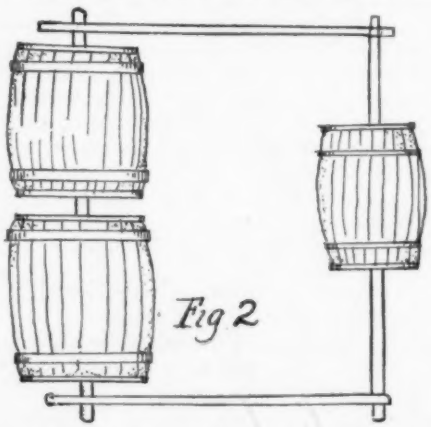
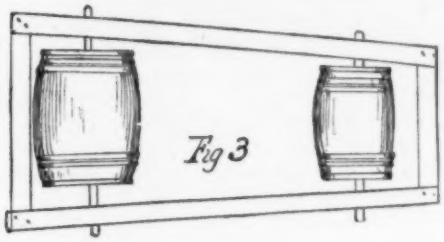


Fig 2

and a small one in the front is presented in Fig. 3. These two barrels are empty oil barrels like the others. The head holes are bored and the proper wooden shafts are inserted and the entrance to the bores closed tight by calking with hemp and putty or clay. The ends of the shafts turn in the wooden frame where the required bores are made to receive the same. If the

journals thus made are well oiled, there will not be much friction. Such a frame can be fitted with a platform and a raft to suit one's individual fancy built upon it, which can be paddled about with ease and



safety on any pond. A sail can be rigged up by using a mast and some sheeting; or even a little houseboat, which will give any amount of pleasure, can be built.

SUBMARINE BOAT WINS IN ENDURANCE TEST.

The submarine boat "Fulton," which has been undergoing some severe endurance tests, has demonstrated fully the wonderful ability of these crafts to weather the rough seas during a gale.

On the night of June 6 this boat remained submerged to a depth of from four to ten feet throughout the night. Once during the night the foul air within the ship was pumped out and fresh air pumped in. The test was entirely without incident. On June 10 the torpedo boat made an endurance run of 60 miles from Newport, R. I., to New Suffolk, L. I., in eight and one-half hours. This was a half-hour longer than the scheduled time, but was caused by the heavy sea lashed into a fury by recent gales. Its ballast tanks were pumped out and it had just a few feet freeboard for the trip and it showed itself to be remarkably buoyant and able to hold its own on the storm-swept waters, although the men had to be lashed to the deck and much of the time the great rollers hid it from the view of those watching from the shore. How important these experiments are is readily comprehended in the light of the fact that each of these tiny boats carries a weapon against which the strongest warship of the world's navies is not proof, and in time the Navy Department may expend more money in constructing these than in building battleships.

A fuel test was also made on the trip, the boat being driven by a gasoline engine.

WHY THE AMERICAN BOY DOES NOT GO TO SEA.

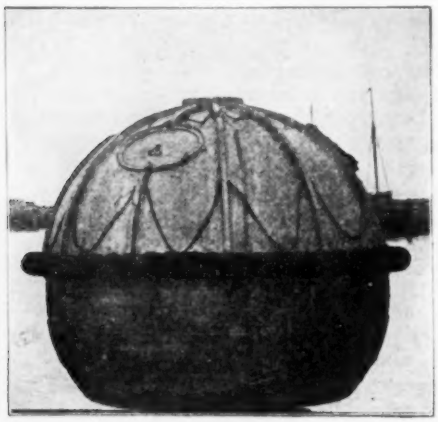
Why has the American boy stopped going to sea? This is a question that has been answered in various ways, but Frithiof H. Buryeson, a seaman of the old school, gives a new version of it in the Coast Seaman's Journal, that is possibly worthy of consideration. Because he can't stand social ostracism, he gives as the main reason—a condition that is brought about by the change of the times. And then Capt. Buryeson hints strongly that these changes have caused the American boy to become timorous and our marine suffers as a result. The American ship, he says, in all material respects has undergone no changes worth speaking of during a century past. The old time captain says:

"There is Dr. Lingeron, who lives on health foods and dispepsia tablets, and who thinks American boys don't take kindly to Old Briny because they can't digest the salt junk and the maggots in hardtack. Prof. Coffin, who wears a chest protector, and is the inventor of a brand new theory on the nature of colds in the head, is quite sure that a ship is altogether too draughty a structure to be a healthy abode for a young growing lad. The president of a 'Woman's Congress' declared, when informed of the fact, that it was simply outrageous that sailors should have their pie served cold to them during the night watches.

"The day has gone by forever when the sons of 'quality folks' run away from home to go to sea. The dreams and aspirations of the young millionaire hopeful of today usually run more to automobiles and to chorus girls than to ships. Prior to the Civil War the personnel of our merchant marine was mostly recruited from the backwood hamlets of New England. The New England boy of that day was a sturdy shoot of a sturdy civilization. His bringing up if applied to the pampered molly-coddles of this age, would land them in a graveyard inside of a year. His food was simple and wholesome, as were his pastimes. Stimulants, cigarettes and poisonous dime novels were unknown to him. He worked hard, but his work was all done in the open air, summer or winter, and it toughened him into a healthy animal, blessed with a good digestion and the ability to sleep on a clothes line with his head on a bucket of water if he had to."

LIFE-SAVING GLOBE MAY SUPPLANT LIFEBOATS FOR SHIP USE.

A life-saving globe, considered by eminent authorities to be the most perfect life-saving craft, with the exception of sailing and managing, for ship use yet constructed, has recently been invented by a Captain Donvig, of Copenhagen, who lost his entire family in a terrible wreck.



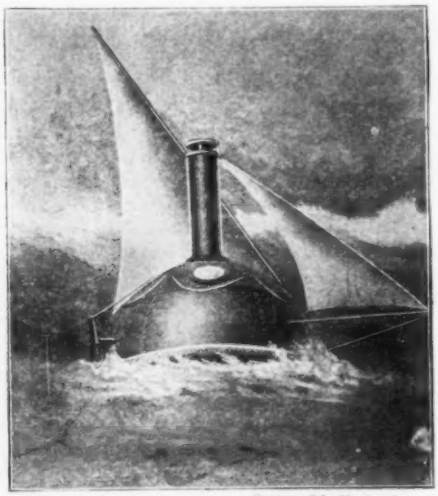
The Globe Closed

These wonderful globes will accommodate 16 persons and are so buoyant that in recent experiments when one was cast from a wharf 12 feet high into the water, it sank a distance and then immediately rose to the surface where it floated safely.

The globe is constructed of 3-16-inch steel plates, says American Consul Frazier, of Copenhagen, Denmark. They are in the form of a globe with a segment cut off, which leaves a flat part for the bottom. The bottom is double and within it can be stored 148 gallons of fresh water. Around the largest part of the globe is a fender of 16-inch coil rope. It is provided with an anchor having 600 feet of rope. The floor is a wooden grating and the sides are padded and provided with straps, with which 16 persons can lash themselves to prevent being tossed about. It also has a bilge pump; closet bucket; steel rudder and tiller, sails and oars. Lockers, in which can be stored 14 cubic feet of provisions, serve as seats for the crew, and for ventilation a 12-inch pipe can be raised through the top of the globe to a height of 5 feet, or lowered flush with the top of the globe. This pipe has a cover and padding for quick opening and closing when at sea. Glass lights in the sides furnish means for observation and man-holes in the upper part of the globe can be opened and closed from within.

The interior dimensions of the globe which was used for experiment is: diameter, 8 feet; height, 6 feet; space, 265 cubic feet; deck area, 54 square feet. Fully equipped it weighs 3,663 pounds.

The second of the tests to which the globe was put was made under conditions in which a lifeboat would have been helpless. The tests were made on the rugged coast of North Jutland when a heavy sea was on and the breakers threatened death. Captain Donvig accompanied by a Norwegian lieutenant of marines and three sailors was put off a ship in one of the globes. After rising to the surface the sails were hoisted and the strange craft steered across the perilous water to the shore. Fifty



Courtesy Scientific American

A Safe Voyage Over Stormy Seas

yards out the men left the globe and waded to the mainland. The trip was made in half an hour and was a success in every respect.

STANDARD SILVER DOLLARS FOR PANAMA.

A silver dollar of weight and fineness equal to that of the United States' dollar is to be used in Panama and the government there will recoin all current Colombian silver (about $1,500,000) into the coin adopted. Additional silver up to the amount of $6,000,000 is to be coined, 15 per cent of which will be banked to retain a parity with gold.

SHOP NOTES

WHAT TO DO IN CASE OF ELECTRICITY ACCIDENTS.

The first thing to do is to have the current shut off, or release the injured person from contact with the conductor of the current, if this is still acting upon him.

The person who attempts this must not touch with his bare hands or skin, or with any part of his body, either the patient or a live wire or a lamp or generator, while any part of his body is in contact with the ground, either directly or by means of a moist or metal surface. He should, if possible, put on rubber boots and shoes and rubber gloves. If these are not at hand he may use a dry board for the feet, and for the hands a number of coats or folds of woolen cloth or paper. A thick bundle of silk is also a good insulator. In cutting a wire, the feet should be protected as just indicated, and if an axe or hatchet be used it should be one with a dry wooden handle. After a live wire is cut, the end should be wrapped or insulated with a piece of cloth or rubber.

The person who has received the shock should be laid down, his clothing loosened and he should be given fresh air and the body should be kept warm.

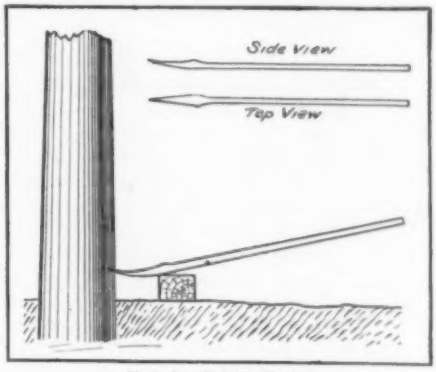
Rescuing from Contact with Live Wires.

If breathing is suspended, artificial respiration or rhythmical traction of the tongue, similar to the methods followed in cases of drowning, should be used. If the heart has stopped beating, several hard taps or blows with the hand may be given which may cause it to start up again. Burns of the surface caused by electricity may be treated in a similar manner to burns from fire.

These suggestions if acted on promptly will often prevent fatal results, but the Fabric Fire Hose Company says a surgeon should be summoned promptly in all cases.

HANDY TOOL FOR PULLING POLES

An ordinary crowbar with the end drawn out and tempered as shown makes a good tool for pulling poles, says the American Telephone Journal. The point of the tool is thrust into the pole near the base and a



Tool for Pulling Poles.

block or other elevation serves as the fulcrum. With three of these tools poles 70 feet long may be pulled and moved ahead 15 feet.

HOW TO TRANSFER PICTURES

Transfers instantly any printed picture on to paper, cloth or dishes. Also transfers designs from magazines on to cloth ready to work or paint. Sometimes used for transferring advertisements onto glass for magic lanterns for advertising displays.

FORMULA.—One bar of common soap dissolved in one gallon of hot water, then add one-half pint turpentine. Let stand over night, stir well and bottle and it is ready for use.

Apply the solution to the picture with a small brush or your fingers, then lay a clean cloth or paper over the picture and rub with the bowl of a teaspoon quite hard, when the picture is instantly transferred. To transfer on glasses or dishes, first varnish the glass or dish with a white varnish and let it dry, then wet the picture same as before and lay the picture face down on the glass or dish and rub on the back of the picture. This will transfer the picture instantly on to the glass or dish.

TOOL FOR MOVING MACHINERY.

A wooden lever made of maple, having the square part 4 by 6 inches and from 9 to

A Wooden Lever

10 feet long will be found convenient for moving machinery, says a correspondent of Power. Such a tool can be used by one man to do work which ordinarily would require two or three. It will take the place of a jack.

SOFT TOOLS FOR HANDLING MACHINERY.

For driving keys and other work about machinery a babbitt or lead hammer is better than a copper hammer which hardens the more it is used. To keep the lead hammer from getting out of shape, take a piece of copper pipe, iron pipe size, drill a hole in one side of it and fit with a handle and then fill in the hollow of the copper pipe with lead.

Even better than the lead hammer are hardwood blocks on end. Put against part to be driven and strike with a hammer. For driving the stub end of connecting rods on large engines back and forth when keyed up, use blocks about 5 inches square and 3 feet long.

CROSSED PULLEY BELT.

Here is a case of a crossed pulley belt. The more load there is on the saw, the more the sag on the lower side of the belt in-

How the Crossed Belt Runs

creases, until the belt contact on the small pulley is greatly increased, and the contact on the driver considerably lessened.

To produce a polished surface on turned work, soapsuds is one of the best lubricants. It should be fed continuously and lavishly upon the tool while cutting. The work must be carefuly dried and oiled when completed to prevent rusting.

TO PREVENT BRONZE CASTINGS FROM ADHERING.

A new method of casting bronze so that it will not adhere to the metal mold and tear away from the casting when forcibly removed, consists in adding metallic sodium, in the proportion of 1½ parts sodium to 100 parts bronze, to the tin of the alloy.

Heat the tin to from 400 to 435 degrees F., and the sodium separately to from 175 to 200 degrees F., excluding the air as much as possible. When the tin is at the heat specified, add the heated sodium. If the tin is more than 435 degrees, the sodium will ignite. When the alloy is cool break it into pieces. It may be laid away for future use if the casting is not to be made immediately.

To make the bronze, heat the copper to about 1,350 degrees F. (below melting point, to prevent the sodium volatilizing), and add the alloy in the right proportion. The alloy will melt and the copper begin to absorb oxygen, thus developing heat. Finally the copper will melt, the fusion of the alloy and copper will follow, and it may then be poured into the molds. During the pouring the remaining sodium goes off in fumes and forms a layer between the mold and the casting, which prevents the casting from adhering and causes it to come out in perfect condition. The coating on the casting, due to oxidized material, may be removed by immersing in dilute hydrochloric acid.

CLEANING GRAY IRON CASTINGS.

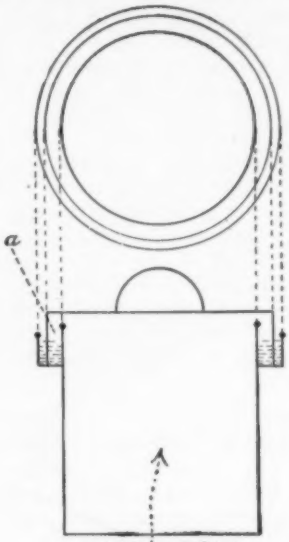
To clean scale from gray iron castings, pickle by immersing in water containing one per cent (not more) of sulphuric acid and let stand from two to three hours. Rinse in cold water and scour with sharp sand and a fibre brush, or with a coarse rag and the sand.

TO TEMPER MILL PICKS AND CHISELS.

Heat the bill to a dull red, and hammer until nearly cold; heat it again to the same color and quench in 3 gallons of water, in which has been dissolved 2 ounces of vitriol, 2 ounces of soda and ½ ounce saltpetre, or 2 ounces sal. amoniac, 2 ounces spirits of nitre, 1 ounce of vitriol. Set bill in solution until cold.

ECONOMICAL GLUE POT.

To prevent an insoluble film forming on the surface of hot glue when not in use it should be covered to exclude the air, thereby preventing the waste due to "skimming,"



GLUE POT.

An ordinary tight cover becomes stuck to the pot, owing to a small amount of glue which is sure to be around the edge of the pot, and which at the same time being uneven, prevents an air-tight joint. To overcome these difficulties I have had a pot made like the accompanying sketch, which explains itself. By filling the space around the pot at *a* with water the cover is perfectly air tight, and nothing prevents its easy removal at any time. The above is sent us by Frank W. Hobbs, Bangor, Me.

LIQUID METAL POLISH.

Take eight ounces of Spanish whiting, which must be perfectly free from grit, and put in one quart of gasoline. Shake up the whiting and gasoline thoroughly. You will notice the whiting settles immediately, leaving the liquid as clear as water. To remedy this, and further to make it a better polishing agent, add to each quart of the mixture 32 drops of oleic acid—no more, no less; shake again and the whiting will not settle. Apply to gold, silver, nickel, brass, glass or any kind of metallic surface with a piece of cotton flannel, rubbing well. Polish with a piece of same cloth.

HOW TO TURN CORK IN THE LATHE

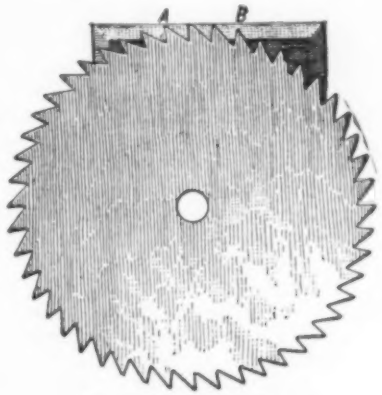
The natural structure of cork causes it to crumble readily, therefore it cannot be turned in the lathe in the ordinary way. However, it can be done by the following method:

First, set the cork revolving, then pass a rather coarse, sharp file over the cork, but at the same time let the file bear upon the tool-rest, or upon a piece of wood fastened to the latter. In this way, the cork will be abraded without serious tearing, and can be shaped as desired, and finished with a finer file.

The essential point is to touch the cork only while the file is in motion *forward*, and while the file is also supported by rubbing against the tool-rest. This support keeps the work running true, and also moderates the pressure upon the cork.

BEVELED BLOCK FOR SETTING CIRCULAR SAWS.

A block of cast iron having a different bevel on each of its four edges to suit the different saws is a good device for setting circular saws, says a correspondent of The Blacksmith and Wheelwright. The block should be about 6 inches square and 2



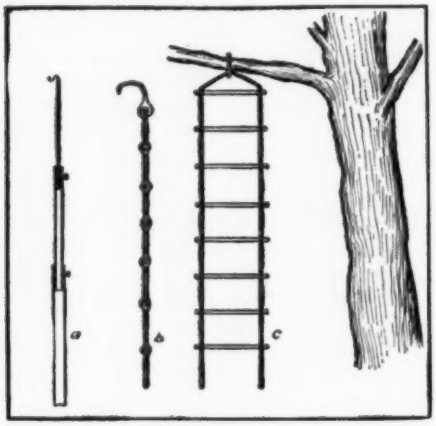
For Setting Circular Saws.

inches thick. Place the saw on the block of iron with the bevel to be used up and hit the tooth B. Use a small-faced hammer to set the teeth.

To soften paint brushes that have become hard, soak them in raw linseed oil for 24 hours, rinse in hot turpentine and repeat the process till clean.

HOW TO MAKE A HANDY ROPE LADDER.

Here is a ladder which, though originally designed for the use of linemen, is adapted to numerous pursuits. For a camping outfit or a nutting party it is just the thing, for it is so light it can be carried in the hand. A bow-shaped piece of iron holds the



A Flexible Ladder

sides of the ladder, and to it is attached an iron hook for hanging the ladder over a bough of a tree. The sides are made of rope with places at regular intervals for fastening in the rungs, as shown at b. A rod (a) for hooking the ladder over a limb is made of pieces of pipe held together with thumbscrews.

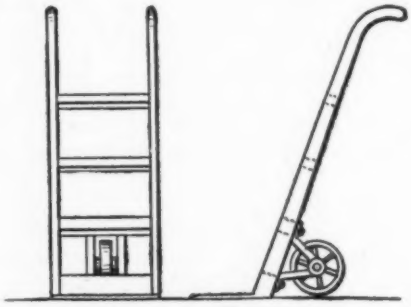
STEAM DOME ON BOILERS UNNECESSARY.

A stationary boiler is better without the steam dome, says the Practical Engineer. The steam dome is supposed to effect a drying of the steam and also add to the steam space of the boiler. Both of these purposes it certainly performs, so that it cannot be objected to upon the grounds of inefficient service. In the first place, it removes the outlet of the steam to a greater distance from the water surface, and consequently there is less chance of carrying water over to the engine when the boiler primes slightly. Being of comparatively large cross-section, the velocity of the steam passing through it on the way to the outlet is comparatively slow. This gives the moisture particles entrained with the steam an opportunity to fall out of the steam by mere action of gravity. However, there are other and better ways of securing the same result. The dry pipe is just as useful in obtaining dry steam as is the dome. It is merely a perforated pipe attached to the outlet, but lying wholly within the boiler. The areas of the perforations when taken together are considerably greater than that of the steam main leading from the boiler. The dry pipe is usually placed so as to extend along the upper part of the steam space and parallel to the longitudinal axis of the boiler shell. It thus draws steam from a large portion of the steam space.

Its main advantage over the dome, however, lies in the fact that its attachment to the boiler does not weaken the shell to any appreciable extent. In order to attach a dome, the shell of the boiler beneath the dome is cut away, thus removing a large amount of solid plate, making the boiler considerably weaker under the transverse strains set up, and also permitting greater distortion.

A ONE-WHEEL MILL TRUCK

A mill truck which has but one wheel, and consequently can be used on a narrow plank for loading bags from or to cars, is made on the same line as a wheelbarrow, says a correspondent of the American Miller.



Mill Truck with One Wheel

In many cases it will be found more convenient than a double-wheel truck, as an equilibrium can be maintained even on a rough path, where the double-wheel truck must of necessity tilt.

To prevent serious results from a wound caused by running a rusty nail into the foot or hand, smoke the wound with a woolen cloth. Twenty minutes of this treatment will cause all pain in the injured and inflamed part to cease.

BENDING SMALL PIPES.

A method of bending small pipe, the bore of which is not large enough to permit filling it with sand is given in The Model Electrician. The tube was cut off to the length

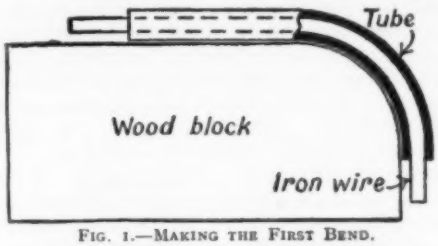


FIG. 1.—MAKING THE FIRST BEND.

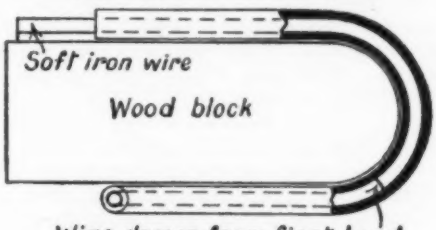


FIG. 2.—THE BEND FOR SYPHON PIPE.

to make a syphon pipe for a small pressure gauge, and a length of small soft iron wire was cut to a little longer than the tube and, the size of wire being just an easy fit in the tube, was then inserted into the latter. The first bend was made at the end where the pipe fits into the boiler, upon a wooden block, and then the wire was drawn out of the curve and the next one bent to shape, and then the wire drawn out. If both bends are attempted without drawing out the wire from the first curve, it will be difficult to withdraw the wire afterwards. In this way small tubes may be bent without damaging them in the least, whereas if the tube be bent without anything in the bore at all, it will surely become flattened somewhere.

COLORS USED IN TEMPERING.

One of our subscribers sends the following list of colors used in tempering. The Fahrenheit scale is used.

Lancets and razors, yellow, 430 degrees; straw, 450 degrees. Wood-cutting tools and taps, dark straw yellow, 470 degrees; yellow, 490 degrees. Chisels, hatchets, saws, etc., and percussive tools, brown yellow, 500 degrees; brown (slightly tinged), 510 degrees; purple, 520 degrees; light purple, 530 degrees. Springs, clear black, 570 degrees; dark blue, 600 degrees.

POWER REQUIRED TO RAISE WATER

Multiply the number of gallons per minute by 10 and by the number of feet the water is to be lifted, and divide by 33,000. Then add one-third for friction, or, if a considerable lift, or through more than two elbows, add two-thirds for friction.

For example, to raise 100 gallons per minute 25 feet through a pipe with two elbows: 100 × 10 gives us 1,000; × 25 is 25,000; divided by 33,000 gives us .757 horsepower, or three-quarters of one horsepower; to which add one-third (.25 or one-quarter horsepower) gives as the result, 1 horsepower.

MAKING LARGE WRENCHES IN EMERGENCIES.

For turning nuts on large unions where there is no wrench of a size suitable for the work in hand, it is not always necessary

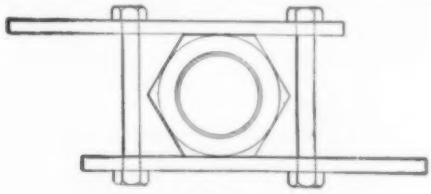


Fig. 1

to forge a wrench, says a correspondent of Power. For a brass union on a 2½-inch pipe take two pieces of iron about ½ by 2½ inches and 18 inches long and two ½-inch bolts. Bore holes for the bolts and screw up as shown at Fig. 1. The two projecting ends coming on opposite sides will serve as handles for turning. Friction is reduced by applying force on two sides of the pipe.

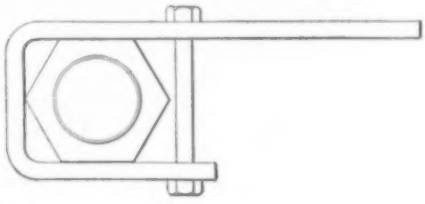


Fig. 2

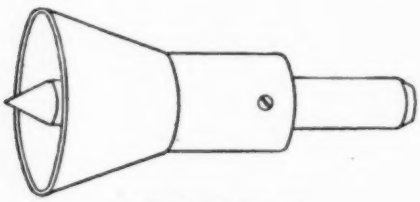
Where there is not room enough to use this wrench, heat a single piece of iron, beat it into the shape of Fig. 2 and join with one bolt. Turn by means of the long handle.

TO LOCATE FIRE ESCAPE IN FACTORIES.

A simple signal to show location of fire escape in factories is to paint one pane of glass red, on each floor, in the window opening on the fire escape. This not only serves as a guide to employes during the day, but if fire occurs during the night indicates to the fireman the location of the standpipes which are placed on the iron ladder.

A BELL-CENTERING PUNCH.

A bell-centering punch is one of the most convenient centering tools in use. It consists of a bell, or cone, which carries a center punch free to move up or down. A small screw put through the top of the cone so that its point comes in contact with a



A Bell Centering Punch.

flat filed on the punch keeps the punch from falling out. Hold the tool upright on the work and give the punch a sharp blow to obtain a center. The illustration is reduced one-third.

TO PREVENT RUST ON MACHINERY.

A good mixture for use as a slush to prevent the rusting of machinery is made by dissolving 1 ounce of camphor in 1 pound of melted lard; skim off the impurities and add enough black lead to give the mixture an iron color. After cleaning the machinery carefully, smear on the mixture. It can be left indefinitely, or if wiped off after 24 hours will prevent rust for some time. When removed, the metal should be polished with a soft cloth.

CARBOLIC ACID FOR TEMPERING STEEL TOOLS.

M. Levat (a Frenchman) recommends carbolic acid for steel tools, claiming more elasticity and pliability than is derived from tempering with water.

TO TRANSFER PICTURES TO GLASS.

Clean your glass thoroughly and varnish it with a clear white or nearly colorless varnish. Put it where it will be clear from dust and let it stand over night. Then take your picture, lay it in clear water for ten to twenty minutes, or until thoroughly wet through. Then lay it carefully upon a piece of blotting paper, so that the moisture may dry from the front and leave the back still wet. Now at once varnish your glass the second time; then place the engraving face down upon the varnish and press down firmly, excluding all the air bubbles. If you have one, it would be well to use a rubber roller, such as photographers use, to press the picture to the glass and exclude all air bubbles. Then rub lightly the paper from the back until transparent and even, then varnish again and dry.

TO CUT SKY LIGHTS.

An ordinary soldering iron is the best to use for the work. Make a notch in the edge of the glass with an ordinary file for a starting place. Heat your iron good and hot and pull it slowly back and forth over the line to be cut and when the line commences to open, keep the iron one-fourth inch ahead of the cut. Keep iron very hot and use point and corners of it.

A GOOD TEMPERING RECIPE.

For small drills, chisels, etc., for very light work, says W. F. Smith of Baltimore, heat to a dull red and cool in a bar of common soap. The temper will be about right and no drawing will be required.

REMOVING INK SPOTS ON MARBLE.

Ink spots on marble may be removed with a paste made by dissolving an ounce of oxalic acid and half an ounce of butter of antimony in a pint of rain water, and adding sufficient flour to form a thin paste. Apply this to the stains with a brush; allow it to remain on three or four days and then wash it off. Make a second application, if necessary.

To find the width of a belt for any required horsepower, multiply 33,000 by the diameter, and then divide the product, first by the length in inches covered by the belt on the driven pulley, and then by half the belt speed in feet per minute.

HOW TO BORE HOLES IN GLASS.

Take an old three-cornered file, one that is worn out will do; break it off and sharpen to a point like a drill and place in a carpenter's brace. Have your glass fastened on a good solid table so there will be no danger of its breaking. Wet the glass at the point where you wish to make the hole with the following solution:

Ammonia	6½ drachms
Ether	3½ drachms
Turpentine	1 ounce

Keep your drill wet with the above solution and bore the hole part way from each side.

Still another way, is to dissolve a piece of gum camphor the size of a walnut in one ounce of turpentine. Use as above described.

ANOTHER METHOD.

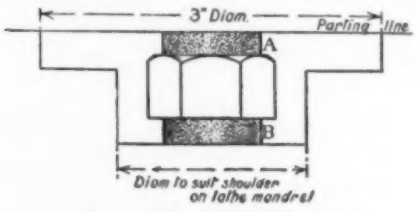
is sent us by a reader who has used the plan for years with perfect satisfaction. He says:

For drilling glass use a steel drill hardened, but not drawn. Saturate spirits of turpentine with camphor and wet the drill. The drill should be ground with a long point and plenty of clearance. Run it fast and feed light. In this manner lubricated glass can be drilled with small holes, up to 3-16 inch size, nearly as rapidly as cast steel.

A FACEPLATE FOR SELF-CENTERING CHUCK.

A self-centering chuck of use to those who have not the necessary screwing tackle, may be made as follows, says a correspondent of The Model Engineer:

Get a good hexagon nut to fit the lathe mandrel, and file the flats up a little, then make a pattern like sketch, allowing 3-16 inch all over for machining. Out of a piece of Bath brick, cut two washers (A and B) exactly ⅜ inch thick, and ¼ inch larger than the tapped hole in the nut. Then glue the washers centrally one on each end of nut, wiping any excess of glue away.



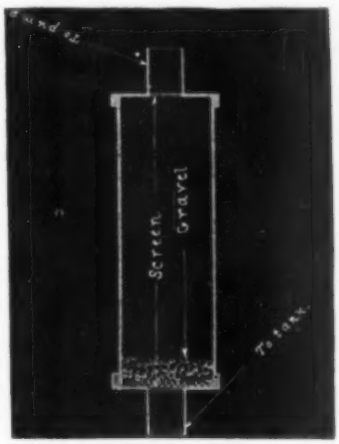
Faceplate for Self-Centering Chuck

Place the nut in center of the mould, so that the metal envelopes the nut, excepting the ends covered by the washers. The writer says he has made three such himself, one for a 3-inch self-centering chuck, and two for emery-covered wooden disks. These were made out of some white metal, purchased cheaply. The Bath brick washers were then scraped out of the casting, which was then screwed on lathe mandrel, faced up, then reversed and treated in like manner.

TO MAKE A GASOLINE STRAINER.

To make such a strainer as is shown in the cut, simply take a piece of common iron pipe five or six inches long and one inch in diameter, threaded at each end.

Obtain a cap which will screw on each end of the pipe. Now drill a hole in the center of each cap and tap to fit pipe used in connecting up the pump with the engine.



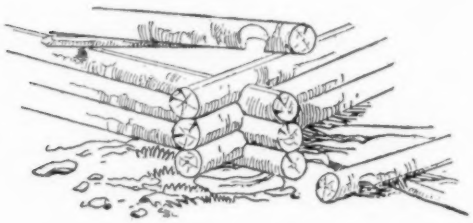
Gasoline Strainer

Cut a piece of fine screen the same size as the inside of the cap. Place the screen inside the cap and screw in the pipe. Next fill the pipe with fine clean gravel (gravel not to be larger than 1-16 of an inch), place the other screen in position, screw on the cap, and the strainer is complete. Place the strainer between the pump and tank.

Have you seen "Shop Notes"?

Permanent Camps and How to Build Them

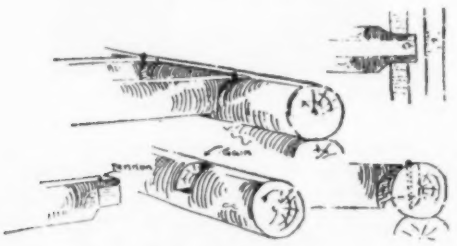
No place could be more picturesque and cozy than the log cabin camp, especially where care in choosing its site has been exercised.



How the Logs Lock at the Corners

Aside from the boating, hunting and fishing advantages of the camp's location, the scenery surrounding it should be considered; it should not be near a swamp, but on high dry ground and, if possible, near a running stream, but always near pure, fresh water. Plan the building to harmonize with its site.

Clear away all decayed trees which might fall on the cabin, stake out the structure according to the plans and clear off the place it is to occupy. For foundation posts use cedar if possible; if not, tamarack, pine or hemlock. Select sound timber about 12 inches in diameter and 5 feet long. Dig post holes down to solid ground or rock, or about 3 feet deep; set the posts, tamping the earth firmly around them. There should be a post under each angle and corner of the building and where these are quite a distance apart, as many in between as necessary. In a distance of 20 feet there

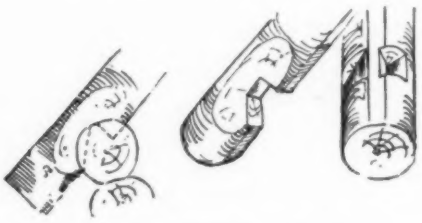


Framing the Joists

should be four posts, including those at the corners, and in 12 feet, three posts. After the posts are set, mark the one in highest ground 10 inches above the ground and cut off squarely. Cut all the others, save those at the ends between the corner posts, on a level with the first one. Those at the ends between the corner posts cut 4 inches higher.

Stone foundation piers, instead of posts, may be made by digging pits 3 feet deep and 2 feet in diameter, filling them up with small stones to ground level and laying large cobble-stones on top of these, chinking up with small stones any places that may remain open.

For building the cabin use straight, sound timber from 6 to 10 inches in diameter. Tamarack, balsam, pine, spruce and hemlock are all good for the purpose. Each log should be cut two feet longer than the side of the building in which it is to be used is to be. Where the tops of the trees are straight and sound they may be used for rafters, joists, etc. If the timber is brought



Framing and Beveling the Rafters

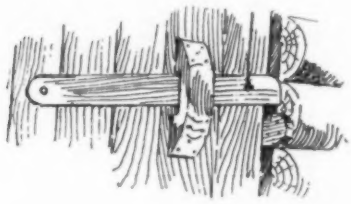
some distance to the building site, it should be placed on skids (two logs) and thus hauled to camp.

For the first tier of logs select the strongest, best shaped and largest of all. These sills, as they are called, should be flattened on the upper side from end to end and in a straight line, and at the narrowest part of the log the flattened space should be 3 inches wide. Place them on the foundation piers so that the flattened surfaces are level with each other. All the other logs for the walls flatten on both sides. When the sills are laid cut notches in the logs and lay the floor sleepers.

To join the logs at the corners, on the under side a foot from each end cut a hollow which will fit over the round side of the log beneath. Place the logs so the large and small ends of them come alternately. Lay the logs carefully, being sure that each log is properly laid before proceeding with

another. Continue laying the tiers until the height of the tops of the windows and doors is reached. At this point saw out the top log the proper width of each window and door to be made, lay the next tier of logs and then resume sawing out the openings for windows and doors.

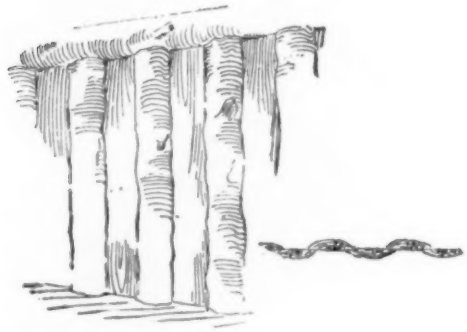
Have ready door and window frames made of boards 1 inch thick and planed on one side. Nail them in the openings to



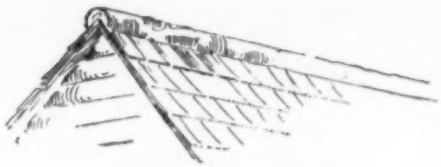
The Door Latch

hold the loose ends of the logs. Make the window sills slanting so they will shed water.

If there are to be two floors to the cabin, at the height of the second floor lay peeled joists, which should be of straight sound timber 6 inches in diameter if the span is 12 feet; thicker if the span is longer. Always place them so they will have the shortest span possible and about three feet apart. Flatten their upper sides from end to end, using a chalk line and a broad axe for the purpose. To place the joists cut gains, as shown in cut, in the logs that receive the joists and make tenons on the ends of the logs Use spikes to fasten them. Where partitions are to run the same way of the joist, place a strong joist under each one. At openings for stairs cut



Partition Made of Halved Logs



How the Roof Should Look

the joists at the proper places and put a crosspiece between two joists across the cuts, joining by means of gains and tenons as before.

In putting up the rafters raise the gable rafters first. The best roof is a steep one. Select and flatten the rafters just as you did the joists. Frame their lower ends to fit the plate-logs and bevel their tops according to the slant of the roof. Use a ridge-pole to fasten the rafters to at the top. Lay them about three feet apart, spike them to the ridge-pole at the top. Select small timber about 4 inches in diameter, flatten one side and halve them on to the rafters, letting them extend over the gable ends about 6 inches. Nail them in place.

If shingles cannot be procured for a covering, bark will do very well. The bark

Crosspieces Where Joists Are Cut for Openings

should be removed from large trees and laid on in long strips, overlapping 6 inches.

For floors use matched and planed pine boards 1 inch thick and 6 inches wide. For the second story floor they should be planed on both sides, unless two thicknesses are used, in which case the boards should be put on with the rough surfaces facing.

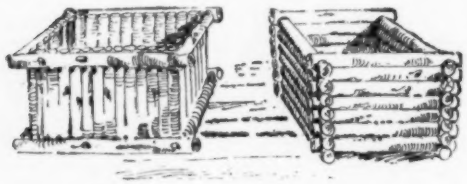
To make partitions saw logs in longitudinal halves, and nail them in form with their flat sides facing and overlapping just enough to hold firmly when nailed together. This will make each side of the partition consist of a round log surface and a flat one alternately. Place a log on top of the partition and spike into place.

Window sash must be procured from some outside source of supply and they should be placed in the frames so they

will be waterproof. Windows that swing out are most convenient. Straps of old leather will do for hinges and a hardwood bar on the sash, having holes bored

A Funnel Fireplace

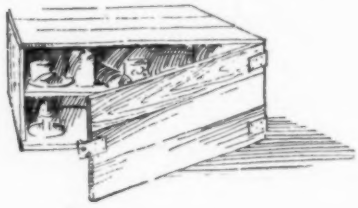
in it to fit over iron pins in the frame will be convenient for holding it open, while a a leather strap to button over the nail will hold it closed. Make doors of matched boards and use braces and crosspieces on them, nailing them securely. If hinges are not to be had, bore a large deep hole at one side of the door in the upper part of the frame, and another directly opposite in the lower part of the frame. In these holes slip the ends of a strong round stick which will turn in them easily. Nail the door on one side of the pole. To fasten the door make a wooden catch and provide a strong bar to work as a latch. Fasten a string to



Two Ways of Building a Wood Box

the latch on the inside and pass it through a hole in the door to the outside. Screens add much to the comfort of a cabin and may be provided if desired.

The fireplace should be built up with the cabin, laying stone foundations for it at the time the other foundations are laid, using cement mortar. The fireplace should be of firebrick, but may have a stone face. The opening should not be larger than 3 feet high and 5 wide and be arched at the top. The fireplace should have a deep throat and the smoke flue should be about 16 inches by 16 inches. Build the chimney of brick, and to prevent the roof from leaking around it lay pieces of tin in the brick work, letting one edge extend under the shingles at the top side of the chimney and over them at the lower and at the sides let the tin turn down against other pieces laid with the shingles. If the chimney reaches above the ridge-pole it will have a good draft without capping it over, but if below the ridge-pole it should be capped. The fireplace may be built up in a ledge to support a mantel, or wooden brackets may be made. A crane may be made by bracing an iron bar to an upright piece. Sockets for

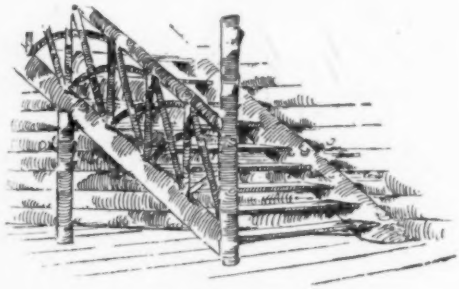


A Packing Box Cupboard

the crane should be built in with the brick and the vertical piece should have pins to fit into them. The arm should be provided with hooks, on which to hang vessels, etc.

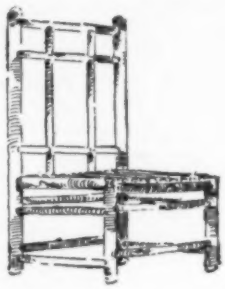
Another kind of fireplace consists of a huge inverted sheet-iron funnel 3 feet wide at its lower part and tapering up to fit the smoke pipe about 12 inches in diameter. The top of the pipe extends above the roof; the funnel is suspended over a foundation of stone, brick or clay 8 inches deep and which supports the firebed which is held together by a frame of green logs. This is a good arrangement for warmth.

In building a stairway the frame is built of poles, and as to the work put on it, one

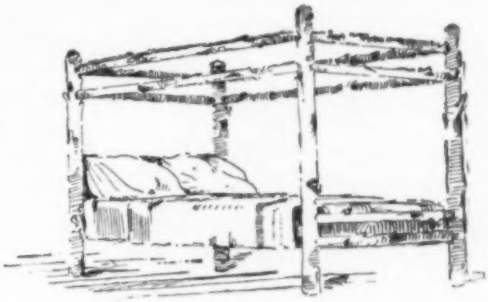


A Rustic Stairway

may suit his fancy. Halved logs may be used for steps and are convenient for many other purposes.



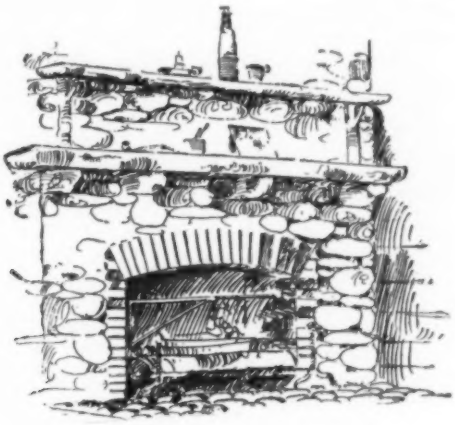
Made of Green Saplings



A Canopied Couch Built of Small Poles

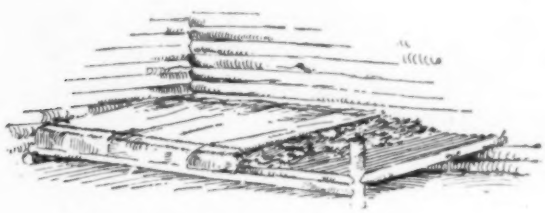
Bunks may be made by placing small straight even poles on a frame work of poles at least a foot above the floor and laying even-sized boughs and fine twigs to the depth of two feet, laying pieces at sides, head and foot to hold the boughs in place and on these laying the blankets or sleeping bag. A packing box can be used for a cupboard by hinging its cover and furnishing with a few shelves.

For furnishings for the cabin there is a wide range for suiting individual tastes. Many articles, such as chairs, beds, wood boxes, tables, etc., may be built of poles and nails. Window seats add to the appearance of comfort and rustic seats can be built for the veranda.

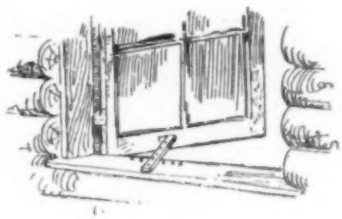


The Fireplace with Rustic Mantel

For the disposal of garbage it is well to dig a hole a little distance from the camp,



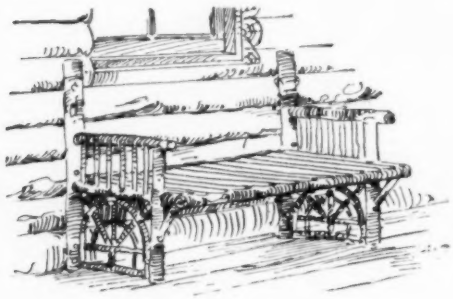
Bunk With a Mattress of Springy Boughs



To Hold the Window Open

sprinkling a little of the excavated material over any refuse that is placed in it.

The cabin may be finished more inside if thought best, but this detracts rather



A Cozy Window Seat

than adds to its appropriateness. Calking should be done as late as possible, so the logs can dry out a little. For calking use oakum or moss, pressing it in between the logs from both sides, using a wooden chisel and a mallet to force it in. Care in the details of the camp will afford a place as inviting and comfortable as can be desired.

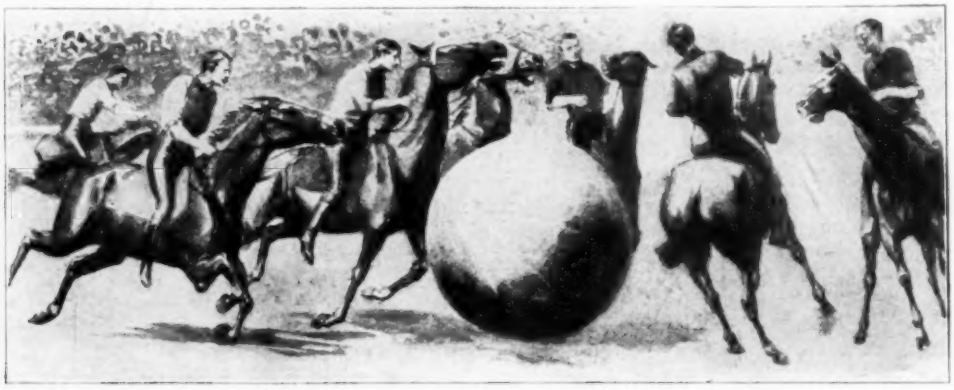
"PUSH-BALL ON HORSEBACK," A NEW ENGLISH GAME.

"Push-ball on horseback" is a new game which was in high favor at the Royal Military Tournament held in England recently. The game was played with an enormous ball by troopers of the Royal Horse Guards splendidly mounted on black horses, three mounted men on each side of the ball. The game consists in the horses pushing the ball about with chests and knees, but the interesting feature of the game is the admirable horsemanship of the participants which has room for fine play. After a time the horses enter into the sport with great zest and appear to enjoy it as much as the men. The game originated with a circus in Germany. The ball, which is four feet in diameter, is covered with leather and inflated like a football.

OILED ROADS IN CALIFORNIA.

A single county in California has 145 miles of oiled highways. The location is near oil fields and the country is quite level. In constructing the roads the roadbed is first graded and rounded slightly and then it is sprinkled with the oil. An ordinary wagon tank is used for this purpose and is provided with a piece of 4-inch gas pipe 10 feet long and having half-inch holes drilled in it two inches apart to serve as a distributer. The oil is applied to a width of about 10 feet. It is then gone over with a harrow and thoroughly mixed. It is applied in hot weather and about 100 barrels per mile are used in the first application. It is then allowed to stand two weeks and then a second application of about 50 barrels per mile follows.

About 50 barrels per mile are used annually to keep these roads in repair at about 25 cents per barrel for the oil and from 30 to 45 cents per barrel for applying it. These roads are fine for driving, but the odor is disagreeable.



Pushball on Horseback

First Lessons at the Forge

Every young man, no matter what his intended occupation or profession, should know something abo ·t forging, welding and shaping metals. The work is at once fascinating, useful and practical. This series of articles will extend through several issues.

PART III.—BENDING, SWAGING AND WELDING

By A. W. Marcy.

Having learned the principles of forming and welding described in the previous chapter, the useful every-day articles will be next in order. The chain links described in Part II if made into a chain will necessarily need a hook on one or both ends.

The hook shown in Fig. 24 is the style generally used on common chains, and is made in different ways. For small chains of ¼ or 5/16-inch links, the method shown in Figs. 25, 26 and 27 is the easiest and quickest. A piece of round iron, a little larger than the diameter of the link which is to hold the hook, is swaged three or four inches from the end to the size of link used, as in Fig. 25. The swaged portion should be just long enough to form the eye when bent to the shape of Fig. 26. Weld the two pieces together as shown in Fig. 27, and punch out the eye large enough to allow the link to work easily. The round shank near the eye should be quite a little larger than the diameter of the link used. Cut off the long end and weld the two ends together, drawing the point down tapering, and leaving the center as large as possible. It is then bent to the shape of Fig. 24, and flattened as shown at A, which spreads the stock out wider, making it stiffer and less liable to straighten.

In making large hooks, select a piece of iron large enough for the largest part of hook, and bend from an inch and one-half to two inches over the corner of the anvil, as in Fig. 28, and hammer it down endways as in Fig. 29. Take a welding heat and weld down solid; punch a round hole in the center and swage down the shank near the eye. Round up the eye on the horn of the anvil by placing the eye on the point of the horn and striking on top with the hand hammer. Another method used largely for steel hooks is to upset the end of the bar sufficient to produce the eye, and proceed as just described. When bent to shape, the draft of the hook should be in a straight line with the eye, as per dotted line B in Fig. 24. Fig. 30 shows a meat hook for holding beef, which is made of round iron, drawn to a sharp point for the hook, and the shank flattened and bent to shape. The sharp corners can be bent in the vise or over the corner of the anvil as preferred.

Fig. 31 shows a coat and hat hook, which is made of ¼-inch round iron about 6 inches long, each end swaged down smaller to within one-fourth of an inch of the end, which leaves a knob. This knob should be rounded up over the corner of the anvil to a well shaped ball. The flat part is hammered down, two small holes punched for screws, and the hook bent to shape.

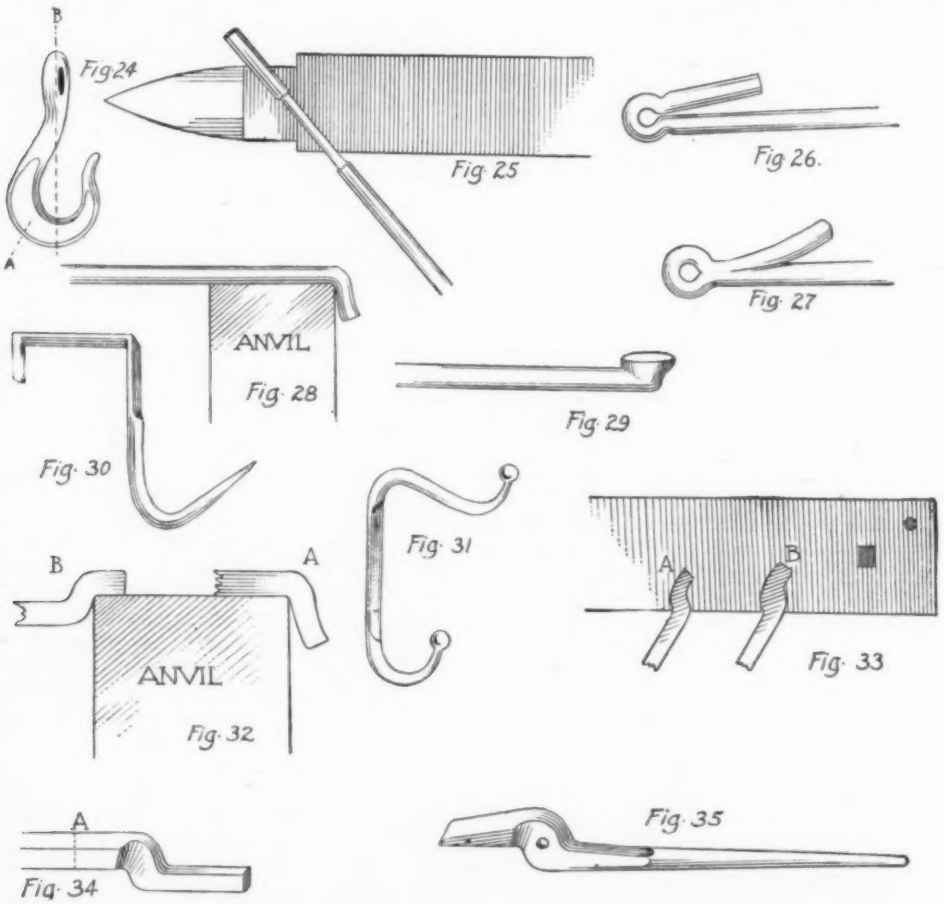
Nearly all kinds of bolts can be made with the aid of different sized heading tools. These tools can be bought of any dealer in blacksmiths' tools, or the amateur smith can make a few himself which will answer the purpose. Steel will be necessary for these, as iron is entirely too soft. A piece of an old wagon spring, a short piece of steel wagon tire, or a piece of a light steel axle will do very well for heading bolts up to ⅝ inch in diameter. Twelve inches is about the proper length for small sized heading tools, larger and heavier sizes being as much longer as desired. Select a round punch the size of hole desired; heat one end of the steel to a medium bright red, and punch the hole nearly to the required size, then drive the punch in from the bottom side, swelling out the bottom until the top side of the hole is a trifle larger than the bolt to be made, being sure the top side is smooth and level, and the bottom side of the hole larger than the top. When heating steel of any kind more care is necessary than in heating iron, as steel will not stand as high a heat.

It is not safe for any but experienced smiths to heat steel above a bright red heat, and the smith who heats steel for the first time should use considerable care, and remember that a fairly bright red is sufficient. In making heading tools of flat

stock, a different sized hole can be punched in each end which makes one tool equal to two. Bolts are usually made by upsetting the stock to form the head, and in cutting off the iron for a bolt for a given length, sufficient stock must be allowed extra for the head, the amount depending upon the size and shape of head desired. A few trials will soon enable one to judge the amount required.

To make a complete bolt it is of course necessary to cut a thread on the opposite end for the nut; this the amateur will be unable to do without thread-cutting tools for this purpose, but the knowledge and practice gained by making the bolt heads will be worth the effort. The same methods can be used to make heads on rivets and pins.

Another method, sometimes used for making heads on bolts, is to drive a common nut on the end of the rod, and weld the two together. This is not as good a method as upsetting, but does very well in an emergency on large sized bolts.



The upsetting of a bolt smaller than ¾ inch can best be done by screwing it in the vise, and striking the hot end with the hand hammer. When upset sufficiently, heat to a good bright red, place in the heading tool and drive it down until the head is the desired thickness; drive out of the tool and square or round up the sides as desired. In making a number of bolts of the same size, upset each one alike so as to have the heads the same size.

As the young smith progresses with his work and tries a larger variety of jobs, he will be unable to securely hold the different sizes with his one or two pairs of tongs, and will feel the need of a few extra pairs. There are several methods of making

tongs, but the easiest for the beginner is as follows: For light tongs ⅝-inch or ¾-inch square stock is large enough. The end of the bar is first bent over the corner of the anvil as shown at A Fig. 32; a second bend is made as shown at B. It is then placed on the anvil as shown at A Fig. 33, and flattened out as at B for the eye; the end at B is swaged down for a stub shank and will now look like Fig. 34. The end of the stub is scarfed and a ⅜-inch round rod welded on for a handle. The jaw is then cut off at dotted line A Fig. 34, drawn down to the proper shape, and the hole for the rivet punched, which completes the piece as shown in Fig. 35. Two of these pieces are necessary for a pair.

When riveting, the parts should be placed together, the rivet heated red hot, thrust through the hole and headed on both sides. This will probably leave the tongs fastened tightly together, but they are easily loosened by heating red hot and opening and shutting a few times. When the tongs are red hot after riveting together, place a piece of ½-inch or ⅝-inch round iron between the jaws and hammer the jaws nearer together, which will form a crease in the jaws for holding round iron. The hardy which the young man uses will become quite dull from constant use; the grindstone will help this to a certain degree, but if dulled very much, it will need "redressing," which is done by heating, hammering and tempering. The "bit" or cutting part should be heated to a medium bright red for an inch and one-half, and hammered out flat to an edge, as when new. If more than one heat is necessary for this, lessen the heat each time until the last hammering or finishing is at a low red. When drawn out, lay aside to cool, and when cold, take to the vise and with the flat mill file, file each side to an edge, being careful to have the edge straight and not too thin.

When filed up, it is ready to temper; but before tempering, the fire should be well packed down with charred coal, a pail of clean cold water obtained, also a small piece of sandpaper or emery cloth.

To heat for hardening, lay the bit on top of the fire, and heat slowly and evenly to a low red, commonly called a "cherry red." The heat must be even, with no hot or cold streaks, and should extend about an inch back of the edge. When at this heat, stick into the cold water for about an inch and one-half, gradually moving it around and up and down. When cold remove and wipe off the water, and polish off one side with the sandpaper, but do not polish too much, just rubbing it bright is sufficient. Hold the bit over the fire, polished side up, and do not blow the fire at all; as the bit gets hot the color will begin to show; when at an even deep blue, cool off and it is ready for use. Constant care is necessary, in heating all steel tools, to heat slowly and evenly and not above a bright red at any time.

The heating, hardening and tempering of a cold chisel, prick punch, or screw driver is practically the same as for the hardy, the same rules applying to one as well as to the other.

In using files there is a right and wrong way as in everything else; the right way is a steady even stroke in pushing, and lifting clear off the work on the return stroke. The cut of a file is on the forward stroke, and unless the pressure is relieved on the return, the teeth will drag and crumble off, soon wearing it out.

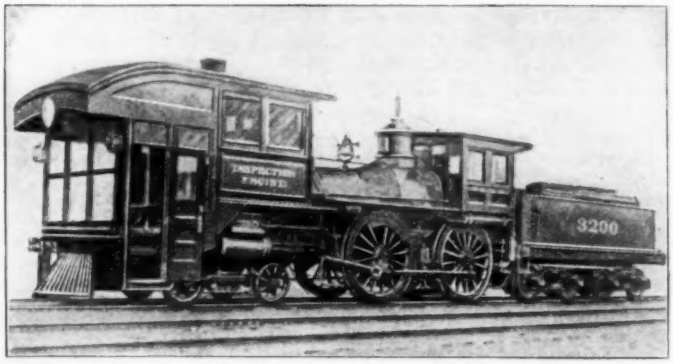
Very little pressure is necessary to make a new file cut, but as the file wears, more should be gradually applied, until it slips and will cut no more. Riveting, whether hot or cold, should be done with a light hammer and medium light blows, as a blow from a heavy hammer upsets the rivet too far down, the upsetting of the end only being sufficient. For all ordinary riveting the 1-pound cross pene machinist's hammer is heavy enough. In performing the different operations described in this series of articles, the amateur will, and must expect to meet with failures, but patience and perseverance will overcome them.

LARGEST GASOLINE LAUNCH IN THE WORLD.

The "Edithia," the largest gasoline launch in the world, is 114 feet long on deck, 103 feet long at the water line, 15 feet 10 inches beam, with 5 feet draught. It is equipped with two 300-horsepower engines and can carry 2,500 gallons of oil. The boat has quarters for eight men, sleeping berths, dining saloon and pantry, and is handsomely finished in mahogany and satinwood. It is rigged with a stack and signal mast. The owner of this launch will use it as a high-speed cruiser between New York and Narragansett.

A PERFECTLY EQUIPPED INSPECTION ENGINE.

One of the most perfect inspection engines in the country is owned by the Burlington and Missouri River Railway. The front end of the 8-wheel engine on which the inspection cab is built rests on coach springs A Pullman car is not more handsomely or conveniently fitted up than this inspection car It has hot and cold water, a wardrobe, steam coils across the front for heating, etc Wherever it is exposed to heat from boiler or smokestack it is heavily lined with asbestos fire-felt. Rubber matting covers the floor and steps and the cab has electric lights; it also carries a powerful electric headlight. Its seating capacity will accommodate 15 persons and the inspector, whose head is but four feet above the rail when seated, has a fine view of the track. The engine can be handled from either the front or rear cab.



Inspection Engine for the B. & M. R. Ry.

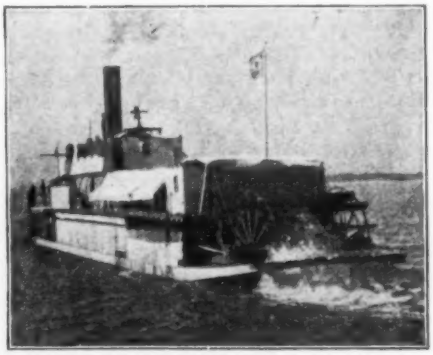
GUNBOATS SHIPPED LONG DISTANCE.

Three gunboats, constructed and erected in a yard on the Thames, England, were then marked, numbered and taken to pieces and shipped by several steamers from London to Alexandria and Port Said, and thence conveyed up the Nile by train to Kosheh, where they were again put together without a single important piece missing. The distance they were shipped was over 4,000 miles

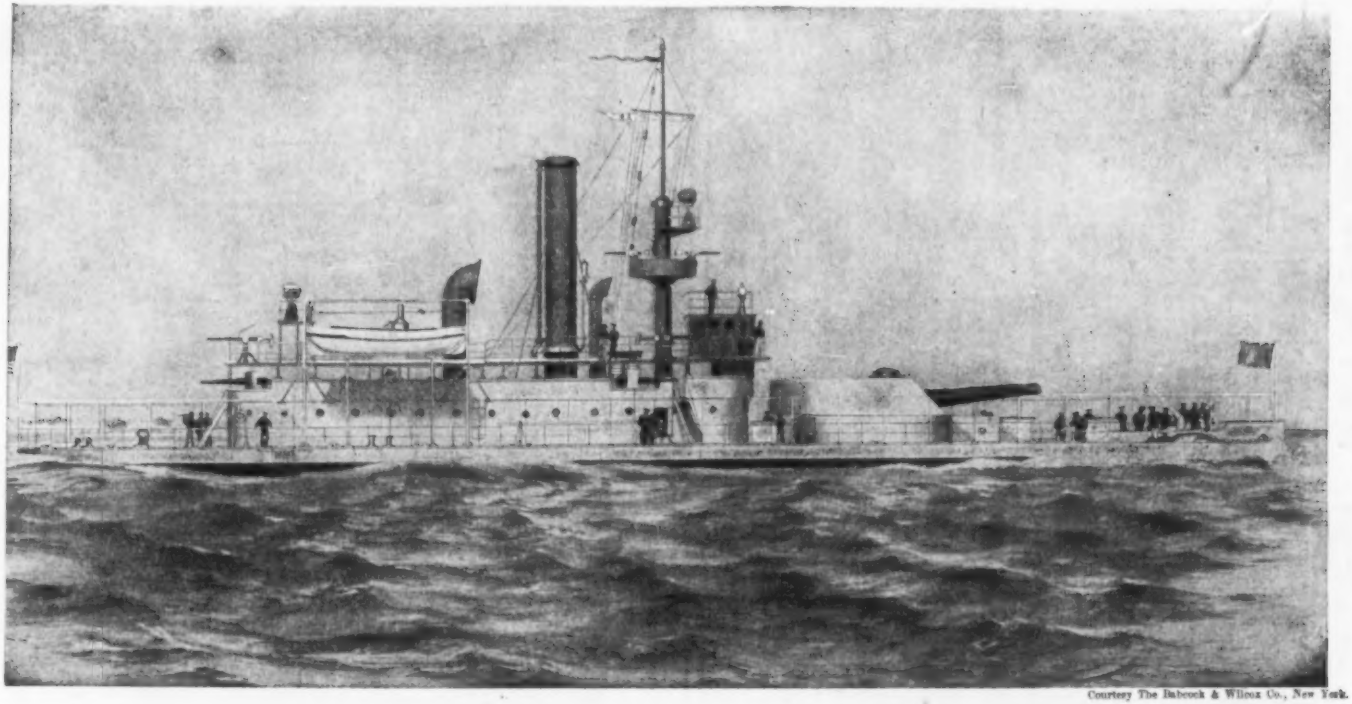
An English paper describes the boats thus.

"The hulls were built of steel in ten sections, for convenience in transport, and were of the following dimensions: Length, 140 feet; breadth, 24 feet, depth, 54 inches; with a draught of water of 24 inches. They had three teak decks, the main, upper, and battery, and above the battery deck was a protected conning tower, some 30 feet from the water-line, which sheltered the steering gear and telegraph, a powerful electric searchlight, and two maxim guns. The hatches to the main deck were arranged to lift outwards so as to form shields for the infantry, shutters being provided to fire through. The armament consisted of one 12-pounder and two 6-pounder quick-firing guns; one howitzer and 12 maxim guns. The guns were served in action by an inner protected lift, and a protected ladder led to the magazines.

"The machinery consisted of one set of horizontal direct-acting compound surface condensing engines, indicating 400 horse-power. Steam was supplied by two steel loco-marine boilers working at a pressure of 150 pounds per square inch. The boilers were placed forward and the engines aft, and a speaking tube connected them. The names of the three gunboats are, 'El Zaffir' (i. e., Victorious), 'En Nazer' (i. e., Majestic), 'El Fateh' (i. e., Conqueror.)"



Stern-Wheel Gunboat, El Fateh, Shipped in Parts Over 4,000 Miles.



Courtesy The Babcock & Wilcox Co., New York.

The United States Monitor "Wyoming"

The monitor "Wyoming" was one of four vessels constructed by the Government for harbor defense. Her dimensions are: Length over all, 255 feet; beam, extreme, 50 feet; draught 12 feet 6 inches. Her armor consists of a heavy water line belt extending full length. Her conning tower is 7 1-2 inches thick, and an armored tube 3 inches thick, carrying telegraphs, wheel-ropes, etc., leads from it. The vessel's maximum speed is 14 1-4 miles per hour.

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The Company owes no debts, has no salaried officers and no office expenses of the Company. There is no promotor's stock. This proposition we submit bears upon its face the evidence of having less "water" and "hot air" in its make-up than any other mining proposition ever submitted to investors.

In the Chicago Tribune of July 2d is an article copied from the New York papers, stating that Senator Clarke of Montana owned the most costly house in New York City, and that his income from his Arizona mines was more than a million and a half a month. Mr. Sturtevant, one of our directors, who is familiar with The Lincoln Consolidated and with Clark's United Verde of Arizona, says that it is the opinion of mining engineers familiar with the surface indications of both properties that the Lincoln Consolidated bears the ear-marks of being the most valuable property of the two.

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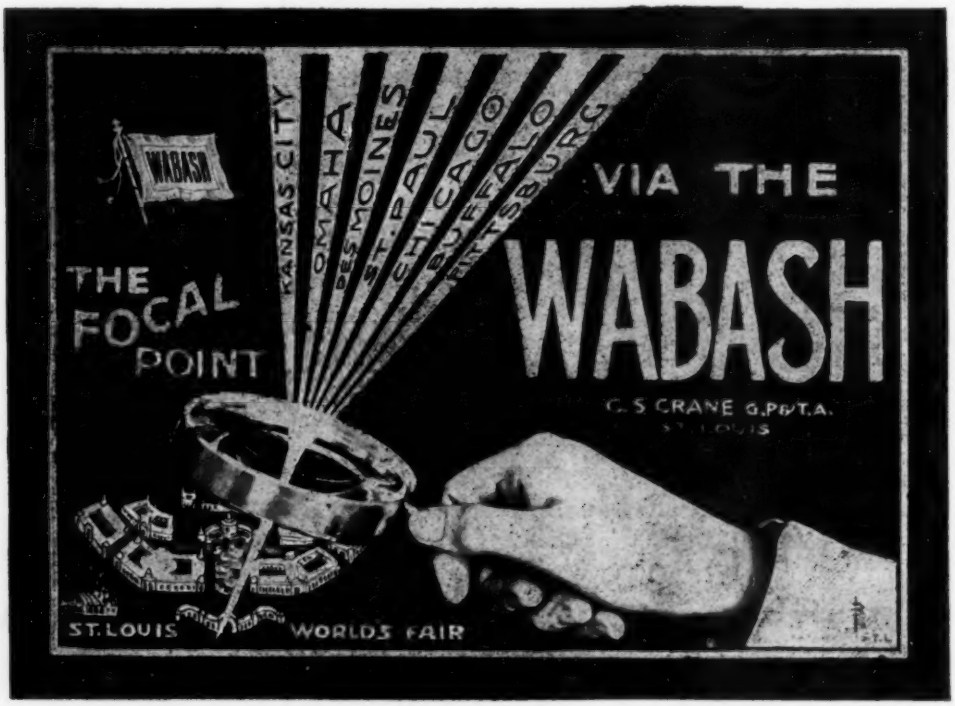

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DRUG FISH TO CATCH THEM.

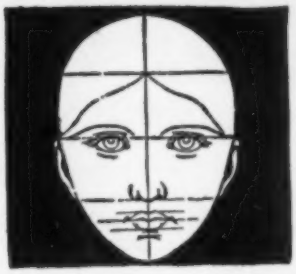
Fishermen in the vicinity of St. Paul are feeding croppies poisonous fish berries in order to render them unconscious so they may be easily caught. The berries are encased in small dough balls which are scattered over the bed of croppies. The fish are greedy for the food and the poison, while having no lasting effect, renders them unconscious for a time, so that they float on the surface of the water and may be picked up.

The practice is a most unnecessary one, the game wardens say, as when fish will take the dough balls they will bite bait on a hook just as well.

SEWED UP HIS HEART.

The most remarkable surgical operation in recent years was recently performed on Edward Pelt, a Chicago office boy, who, because he had lost his position shot himself, the bullet passing through the lung, tearing away much of the tissue and cutting a wide gash at the extreme lower part of the heart.

With blood flowing from the wound, and his strength rapidly waning, the boy was rushed to a hospital. There was but one slight chance of life for him and the attending surgeon took it. On the left side close to the breastbone three ribs were cut through by means of chisels. These ribs were broken, also, at the extreme left side. The flesh was cut on each side of them and laid back like a trap door, revealing the wounded and faintly beating heart. During the slight pauses between beats the surgeon applied his instruments, quickly, surely, until six stitches had closed the wound. Then the tissues of the lung were drawn together and the flap of flesh and ribs laid back over the opening and fastened down. Nearly two weeks have passed since the operation, and the boy has a good prospect of living.



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They are worn without inconvenience and their record for curing rheumatism, either chronic or acute, no matter in what part of the body, is simply phenomenal. They are so sure to cure that the makers send them free on approval to every sufferer they can hear of. Send in your name. Return mail will bring you a pair of the celebrated Drafts. Try them. If you are satisfied with the benefit received, send us One Dollar. If not, you pay nothing. You decide. Don't delay. Booklet for rheumatics also sent free. Magic Foot Draft Co., 851 Oliver Bldg., Jackson, Mich.

IN THE CZAR'S SERVICE.

The room was dingy and but poorly lighted. Around the long table in its center were gathered the conspirators—the men who had sworn to kill the czar. A strange-looking appearance they made in the flickering candle light; some with fierce faces marked with the bitter lines of hunger and of hate; some with the enthusiastic and wrapt expression of dreamers; others with the cold impassivity of great generals. One of the last mentioned, colder, more impassive than the rest, sat at the foot of the table, facing the president. His manner showed not the slightest nervousness, not the slightest exhilaration. Yet in an hour he meant to betray the men who sat about him to the horrors of a living death on the bleak plains of Siberia, gaining thereby the lasting favor of his imperial master. The blow that would ruin his comrades would make him.

The clock struck 8 as the president rose to speak.

"Brothers," he began, "brothers, we have all sworn the same sacred vows, we have all stood the severe tests of our order—we can all be trusted. It becomes my duty, therefore, to speak out. Our days of plotting are passed; the time for action has come. At last we shall strike a decisive blow for liberty."

He paused, but no one spoke. There was not a sound in the room. Some breathed a little more quickly—that was all. Pointing to a powder keg in a corner, the president continued:

"Our materials are at hand—our opportunity also. The czar visits Krasmoe-Selo on Thursday——"

The noise of the scuffle in the hall outside the door interrupted him. Several of the men who sat about the table sprang to their feet, the door burst open, and an officer followed by a squad of soldiers rushed into the room. In an instant every one of the conspirators was covered by a rifle.

"You are my prisoners!" said the officer curtly.

"By what right?" exclaimed the president. He alone seemed cool; the rest stood as though paralyzed. Ignoring the president, the officer glanced at the others.

"Line up against the wall," he ordered.

Silently they obeyed him—powerless to resist. The officer turned to his men and gave a sharp order. The soldiers raised their guns and aimed them at the defenseless breasts of the prisoners.

Again the president spoke.

"What do you mean to do?" he cried.

"To execute you at once," returned the officer coldly. Then to the soldiers: "Take aim! Fi—"

"Stop!"

The cry rang out loud and clear in the deadly stillness of the room, and the spy sprang forward from where he stood against the wall.

"Stop!" he cried.

"Get back," said the officer sternly; but the spy continued to advance. His coldness, his impassiveness, had disappeared; his face was yellow with fear; his teeth chattered; great drops of sweat stood on his forehead.

"No—no—you must not shoot me!" he shrieked. "I am of yourselves—I am an agent of the third section. It was I who informed against these men. If you kill me it will be murder—murder—murder!" He groveled on the floor at the officer's feet.

The doomed men looked at the miserable wretch with bitter contempt, while in the president's eyes there was something that looked like triumph.

"An agent of the police," said the officer, doubtfully. "You have your credentials?"

"Yes—yes!" screamed the wretch, tearing a piece of paper from his pocket and handing it to the officer. "It is there—it is there. Ah, my God!"

This last exclamation was one of renewed terror, for the soldiers, dropping their rifles, had sprung

(Continued on page 862.)

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upon him, and were binding him hand and foot.

The president stepped forward with a smile.

"Brothers," said he to the amazed men, who still stood against the wall, "brothers, in a great cause like ours we can not be too careful. This little scene was devised to discover what traitors we had amongst us. It has succeeded. You, who have proved faithful, are quite safe."

The men looked at him as though they could scarcely credit their senses. Then one or two began to sob, and one man laughed.

"And this spy?" he questioned.

A fierce murmur ran 'round the room. The men, with one accord, started toward the corner where the man lay bound.

"Kill him! kill him!" they shouted.

The president raised his hand.

"Stop!" cried he; "the man is mine—mine to punish as I see fit. Leave him to me. You will accompany our brother, Vassoloff," indicating the pseudo officer, "to a place of refuge. From our friend's admission we are no longer safe here."

"But——"

"I have spoken," said the president, sternly.

The conspirators turned and silently went out. As the man who had laughed passed the spy, he kicked him in the face and laughed again.

Then the president was alone with the spy. He stood looking at him for a moment, with a cruel smile on his white-bearded face. Presently he took from his pocket a long fuse, placed one end in the powder keg, and wound the other about one of the tallow candles, an inch from the burning wick. Then he placed the candle in front of the spy's face, where he could almost touch it, and, turning, went to the door. At the threshold he paused.

"Your fate will be a lesson to your fellow spies," he said, and was gone. The spy heard his steps as he went down the passage; he counted them till they died away in the awful silence of the night. Then he looked at the candle. How long would it take an inch of tallow to burn? The police would not come till 9. Would it last till then? He looked at the clock. Twenty minutes past 8. Would that inch of tallow last forty minutes? If it should not, would being blown up be so painful?

He looked at the candle again. It seemed to melt away before his eager gaze. He tried to shriek, but could not. The bruise on his face where the man had kicked him hurt fearfully; he became unconscious. He dreamed of his mother, dead years before. He thought that he was a child again, and that she had taken him on her lap, and was telling him the old stories that he loved. It was summer, and he could hear the reapers singing. He laughed with happiness.

He opened his eyes. The darkness of the room frightened him, and he tried to call his mother. The gag was still in his mouth, and, like a flash, the whole dreadful sickening truth came back to him. The hands of the clock pointed to 8:40, and the candle was more than half burned. He shook like a leaf—a dreadful nausea sickened him.

Again he looked at the clock—8:50. The candle seemed to burn slower. Was there still hope? Would the police come on time—would they come on time? He strained his ears to hear their coming, but there was no sound. Good God! would they be late?

It was 8:55. He tried to pray. He was lost. No! At last he could hear the soldiers approaching; but the clock was striking 9. A knock on the door, and the flame had touched the fuse. He watched the spark as it crept like a snake across the floor, nearer, nearer, nearer to the keg. He tried to scream. The sound of a door being broken open. The footsteps of men on the passage outside the door, but the spark had reached the keg. A flash—

* * * * *

A second later, when the soldiers entered, they saw a sight that frightened even them, used to fearful sights as they were. A dead man, bound and gagged, lay upon the floor, his hair snowy-white and his eyes staring and protruding.

On the floor was the black mark where the fuse had burned, and in one corner was a powder keg—empty!

A story is told of a Pennsylvania farmer who wore his old suit until everyone was tired of it, and his estimable wife was almost ashamed of the hustling man who had been inside it so long. But one day he went to town to sell his produce, and while there he determined to buy a new suit, and, happy thought, surprise Eliza. So he bundled a neat suit into the wagon and drove homeward. It was after night as he hurried homeward, and at a bridge over a river he stood up on the wagon and "peeled" and threw the despised old suit into the water. Then he reached for his new clothes. They were gone—had jolted out of the wagon. The night was cold and his teeth chattered as he hurried home. He surprised Eliza even more than he had anticipated.

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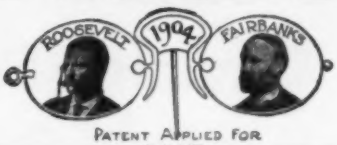
Roosevelt 

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PRUSSIAN GOVERNMENT TO MANUFACTURE SAUSAGES.

Prussian soldiers will soon have the satisfaction of knowing that all the sausage they eat is made of strictly wholesome meat. A big sausage factory is soon to be established by that government at Spandau, a very important fortress near Berlin, reports Southard Parker Warner, consular agent at Gera, Germany. The factory will be in charge of the commissary office of the War Department. The department contemplates establishing other factories in all large cities where large bodies of troops are quartered.

SWEDEN'S GREAT PEAT SUPPLY.

There are 8,648,640 acres of peat moss land in the Province of Norbotten, Sweden, reports American Consul Robert S. S. Bergh, of Gothenburg, Sweden. Besides this there are 1,235,520 acres at Pajala and near the coast, one-fifth of the area being of considerable depth. This, according to the present amount of fuel importation to Sweden, would be enough to supply her for 200 years.

HUGE PICTURE OF EMPRESS.

The portrait of the Empress of China, now on exhibition at the St. Louis Exposition, is a bulky affair. With the pedestal on which it is to stand it occupied nearly one-half the space in the car to which it was transferred from the liner Siberia, which brought it to this country. The picture packed weighs five tons.

In California they built a pipe line 280 miles long for conveying oil from the Kern River district to San Francisco Bay. The oil is so thick that it took five days for it to travel the first thirty-seven miles, and the job as planned has been abandoned for other arrangements.

More than 1,035 questions and answers contained in Spangenberg's Steam and Electrical Engineering, published by Geo. A. Zeller, St. Louis, Mo., thoroughly exhaust the subject and make it an invaluable work for mechanics.

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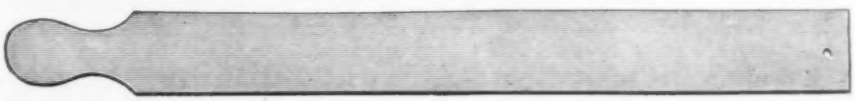

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The ravages of the cotton boll weevil, amounting to millions of dollars annually to our cotton crop, is to be stopped. The government experts have discovered in South America a species of ant unknown in this country, whose special enemy is the cotton weevil. Already a healthy colony of these ants have been imported and will be turned loose in Texas, to wage war on the weevils. The ant is harmless, having no dangerous bite or sting, as do many varieties of tropical ants.

WASHINGTON, THE WORLD'S MAP CENTER.

Geneva, Switzerland, formerly recognized as the greatest map producing center of the globe, has now surrendered the honor to Washington, D. C. Twelve bureaus of the United States government there are engaged in the work of issuing and printing maps of the finest quality and requiring the highest class of workmanship. This has resulted in attracting to Washington the best cartographers and map engravers in Europe. The maps turned out by the government are of every part of the globe. The great confusion resulting from the different spelling of geographical names in each of the bureaus has been done away with by the creation of a board of geographical names. It is the duty of this board to decide upon the name of places and localities before they go to the map engraver and printer.

"SHOE DOCTORS" REAP A HARVEST.

"Shoe doctors" reap a harvest in large cities, gathering together old cast-off shoes left in retail shoe stores repairing them and selling them to second hand junk dealers. A writer for the Shoe Trade Journal says:

Last week an old man with a bag of old shoes boarded a street car on which I was riding. The shoes were old timers and my curiosity forced me to ask questions. The man said he got the shoes for nothing from retail shoe dealers and repaired them so that they sold for from 75 cents to $1 a pair. He had handled 1,100 pairs of shoes last year and hoped to do better this year. Here is a case of one man preventing the sale of more than a thousand pairs of new shoes by his own efforts, in Chicago alone. If only the poor and needy bought the made-over shoes, one would not feel surprised, but the truth is that many thrifty persons who could well afford better, take advantage of the ingenuity of clever cobblers and pay $1 or less per pair.

NEWSPAPER FOR THE DEAD.

A newspaper containing the record of deaths as they occur, together with remarks suitable to each case, and also the name of the doctor who treated each person is to be published in Paris.

The proof of each item is to be presented to the physician it refers to and if he pays a large enough fee the item will not be published. Such a paper would put the "quacks" out of business.

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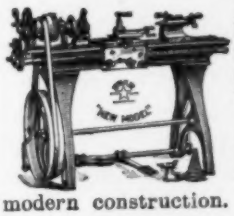

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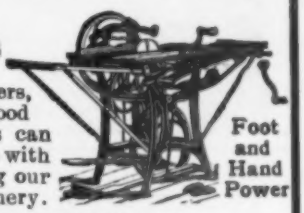

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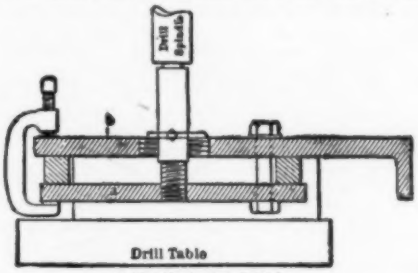
TAPPING LARGE WORK IN A DRILL PRESS WITHOUT A TAP.

A writer in the American Machinist tells how he mended a broken apron belonging to a large lathe, without a tap and in three days' time. He says: The stripping of the parts, molding, and casting the new apron left but one day to machine it. Two of the large gear studs to be refitted were threaded 10 to the inch, but there being no lathe large enough



A Vertical Lead Screw

to swing the apron, chasing a thread in this manner was out of the question. Accordingly, the tip of the boring bar used for making the holes was turned down to three-quarters inch and threaded ten threads per inch. An ordinary iron strap *a* was tapped to match and clamped just below the apron *b* to be threaded as shown in the accompanying sketch, the strap acting as a leader for a thread-cutting tool which was inserted in the boring bar.

ARRESTED BY TELEPHONE.

Automobiles are getting pretty fast these days, but the telephone is quicker. A little girl was crossing one of the crowded streets of Cleveland when she was run down by a careless driver. Firemen at an engine house near which the accident happened tried to catch the fellow, but he drove rapidly away. One of the firemen hurried to a telephone and called up a police station toward which the man was driving. He gave a description of the man and told the police to be on the lookout. In a few moments the offender was under arrest.

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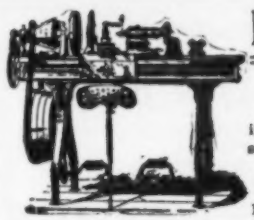

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WHAT IS A PATENT?

In an address before the Lewis Institute, Samuel G. McMeen said:

"This bargain is to the effect that because the inventor furnishes to the people a more or less useful product of his brain they in their turn guarantee to pay him for his effort. The payment is not made in a definite sum of money, but is an arrangement whereby he may enjoy for seventeen years all the profits coming from the use of the thing he has produced. Rights to these profits he may sell or rent to others or make such disposition as he likes; but from the time of the making of the bargain the thing belongs to the people. At the end of the seventeen years the inventor has no further claim on his production, and it belongs thereafter wholly to the people, having been bought and paid for.

"In a sense, the price paid by the people is set by the inventor. It may be very large or very small, depending on the excellence of the invention or on the caprice of the people. Examples will come to mind of inventions almost trivial, so far as real usefulness is concerned, but which give the inventor large financial returns. There are other examples of inventions which were epoch-making, but because they were too soon for the minds of the people, brought no financial return. It may be that if they had been invented later, so that the period of monopoly had coincided with the period of welcome, the reward might have been proportionate to the excellence of the conception.

"The industrial greatness of this nation is in large measure due to the existence of good patent law and to the encouragement which has been given to inventors by its operation. The inventive ability of a people lies not alone in its facility in finding ingenious ways of setting things together to achieve results, but also in its wisdom to see clearly industrial and social needs. In the instance of the inventor who produced the cranberry sorter, every one in the cranberry industry knew the need of sorting so that cranberries for market would contain no soft ones. It required a mental aptitude to see an immediate possibility of invention in the circumstance that when cranberries were spilled down the back steps only the sound ones hopped from step to step, the soft ones stopping early.

"It is not true that a patent granted by the United States may be renewed. A reissue is not an arrangement by which an expiring patent may be given new life, but only an arrangement whereby a necessary correction may be accomplished. In other countries there are periods of patent life which, by proper action, may be extended somewhat as in the case of a copyright in this country; but in each case there is an ultimate time beyond which the term of the patent can not be extended.

"An applicant may not secure a patent in this country if his invention has been in actual public use for two years or more before he makes his application. Interesting questions sometimes arise as to whether the use has been really public or might not have been wholly for the purpose of testing the efficiency of the invention by a continued test. A form of sidewalk which had been in use for two years was held not to vitiate the rights of the applicant because, although distinctly in public use, the excellence of its form could only be proven to the

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inventor by actual trial, and could not be considered to be a final test unless continued for a considerable time. In another instance of an article of wearing apparel distinctly not public in its use, a period of two years was held wholly to vitiate the rights of the applicant because very much less than two years should have sufficed to enable him to decide whether the invention was or was not in a proper form for filing his application."

HANGING MORE HUMANE THAN ELECTROCUTION.

Several recent cases of electrocution have stirred grave doubts in the minds of many who formerly believed this to be the most humane method of execution. Now the question as to whether hanging, which, when properly managed, means instantaneous death, is not the best way after all, is being discussed, and those states that have adopted electrocution, unless steps to make it an infallible means of quick and painless death are soon taken, may go back to hanging.

One New York criminal recently was electrocuted three times before death resulted, and after the second attempt, had been taken from the chair before it was perceived that he still lived. In another case the sufferings of the victim were most horrible, and reminded men of the dark days of the rack and the thumbscrew.

HOW TO OVERCOME A DOG.

With the exercising of a little science and trickery a small man can easily protect himself from the assaults of the fiercest of dogs and generally come out victorious without receiving any punishment. Here is the method of defense as is contained in the Rev. Dr. Newman Hall's autobiography:

"Take off your hat and hold it in front of you. The dog will at once bite the rim. Then kick violently under your hat, and the distance being exactly that of your leg, the toe of your boot will strike the lower jaw of the dog, who will at once go off in great pain."

The plan was given to Dr. Hall by a farmer. The very next day he was crossing a field, when a fierce dog ran at him. There was no refuge near. He had no stick. He remembered his lesson. In an instant the dog rushed howling round the field, and the grand old dissenter with a very slight wound in his hat went his way.

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In renewing his subscription to Popular Mechanics, L. H. Chapman of Okeene, Okla., says: "I do not see how any one who is a mechanic or an overseer or foreman of a number of workmen can do without it."

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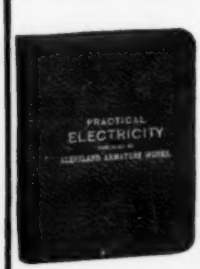

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His well beloved grandmamma falls dead
  A dozen times or more.

Third, like a furnace does he sigh;
  Of course we know the gist;
He tells the maiden fair she is
  The first he ever kissed.

Fourth age, he comes home in the morn
  And gladness fills his cup—
The good Samaritan has been
  With sick friend sitting up.

Fifth, to the woodshed he repairs
  His heir to interview,
And says: "My son—kerswat! Kerswish!—
  This hurts me more than you!"

He next has leisure on his hands
  And fills a jug with bait;
He hooks a minnow, then he swears
  Ten pounds to be its weight.

Last age, when lean and slippered grown
  He finds his greatest joy
In telling what perfection ruled
  The days he was a boy.

—New York Sun.

RATS MADE OF OAKUM—A SEA YARN

An amusing yarn is current in Sydney maritime circles. It is to the effect that the captain of a well-known Australian clipper, the "Caduceus," wishing to clear his ship of rats, offered his crew a glass of grog for every rodent killed or captured. The result was speedily apparent in the diminished number of rats, yet, somehow or other, there were always a few, the crew, anxious for supplies of grog, having devised a means of manufacturing them out of oakum. The captain's curiosity was aroused one day by noticing a supposed rodent floating very "light" on the port quarter. He waited his chance, and when the next man appeared with a rat, the captain remarked, "Throw it to windward." The result was dead against the sailor, for the oakum rodent was blown back on to the poop. Thenceforth there were no more rats and no more extra grog.

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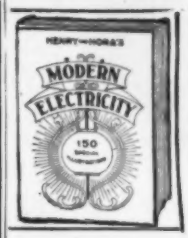

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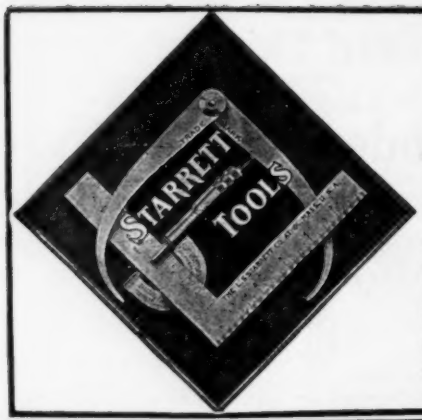

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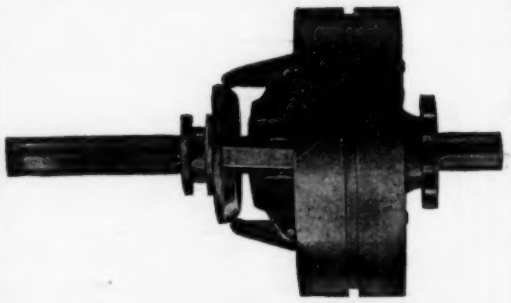

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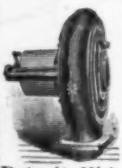

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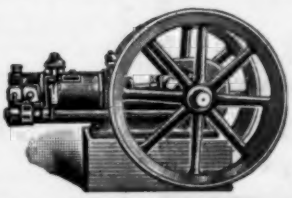

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GREATEST IRRIGATION RESERVOIR IN THE WORLD.

Arid Arizona is soon to have a vast water storage. For some time the government has been actively employed in the construction of a great dam at Tonto Basin, some 80 miles northeast of Phoenix, Arizona. This is among the first work commenced under the act of Congress appropriating $15,000,000 for the reclamation of arid western lands.

The famous Tonto dam will represent the greatest water storage enterprise in the world, as it will produce the largest artificial body of water ever known in the history of the world. Notwithstanding the Nile reservoir covers a large area, it is only a few yards deep; while the Tonto reservoir will, in places, be over 200 feet in depth.

After months of investigation on the part of the government surveyors Tonto was selected as the best point along Satt river for the construction of the stupendous dam. The flow of Satt river is so variable that the stream cannot be depended upon to irrigate the vast tracts of sterile soil without water-storage.

While the government is advancing the money for the building of this colossal dam, it will ultimately be repaid by the land owners. Already nearly $1,000,000 has been expended in preliminary work, and it is estimated that an additional $2,000,000 will be required to complete the work.

The storage of water will keep pace with the construction, so that the great benefit the government is bestowing will be realized at once.

This Tonto reservoir will extend 18 miles up Satt River and 12 miles up the Tonto, and on an average will be four miles wide. It will drain an area of 6,000 square miles of mountains mainly covered with dense forests.

The dam site is 600 yards below the mouth of the outlet cañon at the junction of the two streams. The dam is being built with a crown pointed up stream. It will be 270 feet high, and 225 feet wide at the base—tapering upward to a 16-foot roadway at the top, over which will pass a United States mail highway.

At the dam site the cañon is only 200 feet wide at the base of the dam and 400 feet at its top.

The dam is being built of rocks weighing up to 12 tons, laid in Portland mortar, and water-tight. The bedrock strata tips up stream, thus rendering sliding impossible; while the dam will be on so massive a scale that it will become a veritable part of the towering mountains surrounding the reservoir site. It will be able to resist any pressure the elements could ever bring against it.

What is ultimately to become the bed of this reservoir, is now studded with beautiful ranches, the rights of which have already been purchased.

The preliminary work of this enterprise is on a great scale. It includes saw mills, an electric plant, a cement mill, a power canal 15 miles long, the opening of 100 miles of difficult mountain roads, telephone lines, piping water three miles for domestic purposes, a cable-car line, derricks, blacksmith shops and many other minor industries.

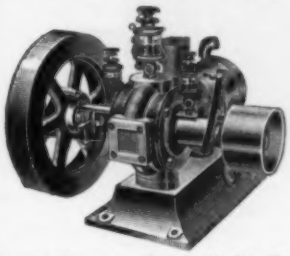
A large stone quarry has been opened and immense quantities of lime and brick are being burned. All material for making first-class Portland cement has been found within seven miles of the dam site.

The line of work extends for 85 miles from a point 42 miles east of Phoenix to the saw mill in the heart of the Sierra Anchas. Camps have been established all along this line, and the domestic and culinary problems are scarcely second in difficulty to those of the engineer and mechanic.

A great army of men, teams and machinery will soon be engaged and the "commissary supplies" will be similar to those in conducting a war campaign.

Many months will be required to complete the work. The benefits, in an agricultural way, to accrue to that part of parched and arid Arizona by this stupendous water-storage will be immense.

SMALL GASOLINE ENGINES



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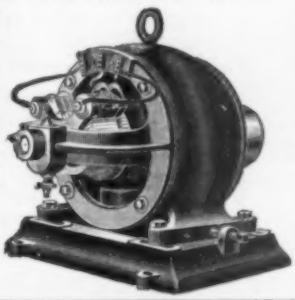

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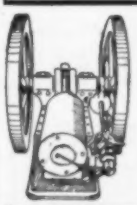

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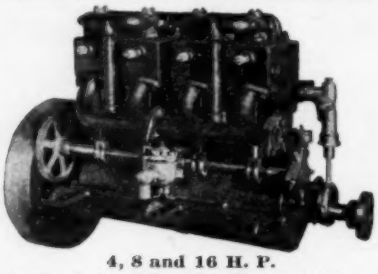

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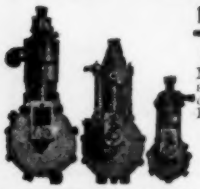

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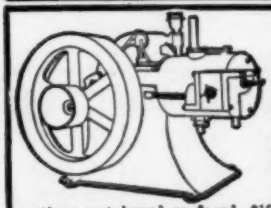

1-4 H. P. Gas Engine
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L. W. GILLESPIE & CO., 238 E. 4th Street, MARION, IND.

THE PROFESSOR'S BLUNDER

John W. Mackay was an early riser, a hard worker and, although exceedingly hospitable, was himself abstemious and could seldom be induced to play cards for money, and then for only nominal stakes. The game he liked most was one by which the mining superintendents on the Comstock beguiled a portion of the noon hour while waiting for luncheon at the Savage Co. hoisting house. Boys caught grasshoppers and sold them to the players at 25 to 50 cents each. Each player paid a fixed stake, ranging from $1 to $20, into the pool, and the man whose hopper made the longest jump captured the pool. One day before Christmas it was agreed to celebrate that holiday with a pool, the stakes in which were to be $1.50 for each player. The terms were "play or pay," and at the instance of a German professor, who was a superintendent of a leading mine, each man was allowed to use any means that he might devise to stimulate his grasshopper. The professor was so full of his scheme to scientifically capture the $1,000 pool—for there were 10 entries—that he communicated it to a young assayer who was not a grasshopper plunger. The professor had experimented and ascertained that a grasshopper that was touched by a feather dipped in a weak solution of aqua ammonia would jump for his life. The young man also experimented, and as a result he filled a bottle of the same size and appearance with cyanide of potassium and managed to substitute it for the other in the professor's laboratory. The next day, when the professor, after much boasting about his scientific attainments, dipped a feather in the substituted bottle and touched his insect with it, the grasshopper rolled over as dead as a salt mackerel, amidst the roars of the crowd. Mackay's hopper won the big pool, and two widows, whose husbands had been killed in the Yellow Jacket Mine, received a gift of $500 each from an unknown source.

ABOUT THE SIZE OF IT.

It's almighty queer, but the fact is quite clear
  That most of the people today
Who get in the papers, cut up some wild capers,
  And get advertised in that way;
While the people who do what is honest and true,
  As a rule never get any praise,
But the fellow who's tough, finds it easy enough
  To rush into print nowadays.

Would there be any hint of a story to print
  If a man kissed his wife at the door?
But if he should kiss some alluring young miss,
  Dear, dear! how the papers would roar!
It's queer that the man who is straight never can
  Get credit for honors well won,
While the rascals and crooks fill the papers and books
  With stories of what they have done.

If a trusted cashier remains year after year
  In the bank, where he's toiling away,
Without stealing the cash, does he cut any gash
  In the news columns day after day?
But oh, how they'll spout if the fellow skips out
  With all of the greenbacks and gold!
While his whole pedigree in the papers we see,
  Where the story is spicily told.

Don't look to the press or its columns to bless
  The good deeds men constantly do;
Such items they choose to turn down as "no news,"
  They want something "spicy" and "new."
When a story you see that is unmercifully
  "Scareheaded," you don't have to look
Very far through the stuff till you know well enough
  That it deals with a rascal or crook.

—Sunset Magazine.

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CHEMISTRY has become a necessity not only to the manufacturer, but also to everyone directly or otherwise interested in manufacturing industries. There is no branch of human endeavor in which a chemist cannot help you. We can analyze and tell you how to duplicate and save money in the manufacture of any preparation on the market. Tell us your troubles and we will help you.

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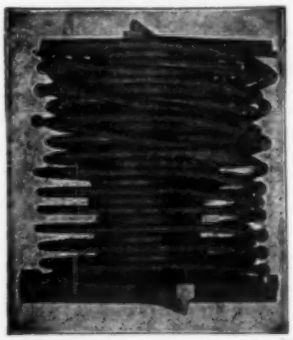
Our New **FLASH BOILER**
For 1904



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Diameter 9 inches, run by dry cell battery; weight of fan and battery only 15 lbs. Can be carried and set up anywhere; always ready to start. Invaluable in the sick room, at the dining table, or on the office desk.

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You know how the old-fashioned Door-Hanger sticks

Ours Will Not Bind

Ours Cannot be Derailed

Let Us Tell You About It

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ALLITH MANUFACTURING CO.

120 South Green Street, Chicago

DOBBIN'S DESPAIR.

I have no differential clutch
And no pneumatic tire;
I guess I don't amount to much,
For none come to admire
My form or speed—I have no cam;
And, to my deep remorse,
I must confess I only am
A one-horsepower horse!

They used to stroke my sorrel side
And tell how I could go;
Today they speak in tones of pride
Of some bright red tonneau.
But, though my sorrow is so great
And anger is so keen,
I'm glad to have a chance to state
I don't eat gasoline.

I don't know how to carburet,
Now how to radiate—
When I wished to get up and get
I simply struck my gait.
'Tis true, in casting out the beam
For fairness I should try—
But 'lectric, gasoline or steam,
The "mote" is in my eye!

I have no wondrous steering gear—
But still they rush to see
A thing that has, I'm pained to hear,
A horseless pedigree.
They used to pet me all the time,
But now they only shrug
Their shoulders, and pass by, for I'm
A poor old sparkless plug!

ELECTRICAL ORE FINDERS.

The several inventions for locating veins and bodies of ore by means of electrical instruments have been looked upon with more or less doubt. A recent demonstration in England, before a number of electrical experts, including several scientists of note, determines the fact that some of these instruments are capable of very reliable work, while not able to perform miracles. Dr. Thompson said: "It is quite certain that where there are well defined lines of ore underground, they can be localized by means of the apparatus." He had been skeptical, but is now convinced of its utility in locating such bodies as galena and other conducting ores, but was not so sure in the case of gold mining.

ROTHSCHILD'S "SUCCESS RECIPES."

The following twelve maxims form part of the will of Mayer Anselm Rothschild, the founder of the great banking house at Frankfort. They are going the rounds in Europe and America:

1. Seriously ponder over and thoroughly examine any project to which you intend to give your attention.
2. Reflect a long time, then decide promptly.
3. Go ahead.
4. Endure annoyances patiently and fight bravely against obstacles.
5. Consider honor as a sacred duty.
6. Never lie about a business affair.
7. Pay your debts promptly.
8. Learn how to sacrifice money when necessary.
9. Do not trust too much to luck.
10. Spend your time profitably.
11. Do not pretend to be more important than you really are.
12. Never become discouraged, work zealously and you will surely succeed.